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COCHIN, INDIA

भारतीय कृषि अनुसंधान परिषद
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

समुद्री मात्स्यिकी सूचना सेवाः समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

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Front cover photo : *Penaeus indicus* or white prawn — a highly demanded marine prawn found along the Indian coasts. Photographed at Neendakara Fisheries Harbour in Quilon District, Kerala.

मुख आवरण चित्र : *पेनिअस इन्डिकस* या श्वेत झींगा — भारतीय तटों में पायी जानेवाली उच्च माँग का समुद्री झींगा — नीण्डकरा मात्स्यिकी पोताश्रय में खींचा गया फोटोग्राफ ।

NEW DIRECTOR FOR C.M.F.R.I.

Prof. (Dr.) Mohan Joseph Modayil has taken over charge as the New Director of CMFRI on 2 September, 2000. A renowned scientist and a teacher, he has contributed greately to the cause of marine sciences. He possesses a first class Masters Degree in Marine Biology and a Doctorate degree in Bioscience. He has to his credit 32 years of research/teaching/developing work in the field of artisanal fisheries in many developing countries. Before joining CMFRI he was Professer and University Head of the Department of Fisheries Resources and Management, College of Fisheries, University of Agricultural Sciences, Mangalore.

Dr. Mohon Joseph Modayil is an accomplished scientist whose contributions in the field of community based coastal resource management (CBCRM) and mariculture have been well recognised by national and international organizations. He has also worked as visiting scientist in the University of Nort Wales (UK) and the University Science Malaysia. He served as consultant from 1987 till now to various international organizations such as ODA-PHFP, British Council, DFID of the the British Government, IDRC of the Canadian Government, IFRTO of the Islamic Republic of Iran and has travelled widely abroad covering more than 15 countries. He has to his credit more than 90 publications which include research papers in national and international journals, reports, articles, manuals, book and reviews. Till recently he was the honorary Secretary of the Indian Branch of the Asian Fisheries Society and the Country Co-ordinator for the PHF Project of the Department for International Development (DFID) of the British Government.

While addressing the staff of the Institute, soon after taking charge, the New Director outlined his priorities in the Institute. He stressed the need of strengthening the marine fisheries sector by answering contemporary problems in R&D and by developing new technologies for augmenting resource production. He highlighted the need for perceptional changes, motivation and commitment through human resource development to address challenges ahead and to reinforce future research programmes. Dr. Modayil said that he has plans to bring the Institute to the forefront by establishing linkages with intitutions in other countries especially in South Asia, Africa and Latin America. In view of the unscrupulous exploitation of the living resources and consequent deliterious effects on the resources, he felt that the Institute's immediate attention should be to study the biodiversity of all the marine stocks for which a separate Division would be created in the Institute. Recognising the key role the Library should pay in any R&D institute, he said that all efforts would be taken to make use of the possibilities of the modern information technology by further strengthening and modernising the library at the Institute. He also outlined the concept of developing CMFRI into an international centre for tropical maricultue to serve the researchers and seafarmers of the tropical region.

940 ESTIMATES OF OPTIMUM FLEET SIZE FOR THE EXPLOITED INDIAN SHELF FISHERIES

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Introduction

A characteristic feature of marine fish production in India is its annual fluctuations, as vividly shown by the statistics of production for the past four decades. This phenomenon has led to considerable uncertainties about investment in the production process. Marine fisheries still remain open access and suffer from overcapitalization. The nearshore region within the 40 to 80 m depth range, covering an area of 0.45 million sq. km, is subjected to heavy fishing pressure. About 2,43,000 fishing vessels (1,82,096 artisanal craft, 26,171 motorised craft and 34,571 mechanised craft) exploit this area, where the estimated annual potential is 2.2 million tonnes. A conservative estimate of investment on fishing implements (craft as well as gear), at current prices is about Rs. 33.4 billion, but the return per unit investment seems hardly viable. Unhealthy competition and unregulated fishing may decimate the exploited stocks and therefore, the question of deciding the optimum size of fishing fleets which would allow sustainable yields becomes very relevant. An exercise to answer the question requires large amount of information on the physical parameters of the vessels, economic indicators of fishing operations and the vital statistics of fish populations. The integration of these parameters into a succinct mathematical model is time consuming, especially in view of the multiplicity of fishing operations and the consequent complexities of computation. Nevertheless a macrolevel exercise was attempted and the results described here.

Method

In a multispecies, multigear dispensation, it is often observed that the catch per unit effort of a given type of fishing unit does not reliably indicate stock abundance nor the efficiency of that unit. The competition for the same resource by many gear of varying characteristics and dimensions does not facilitate a reliable index of abundance of any fish. Nevertheless, more than anything else, catch, effort and catch per unit effort (CPUE) set the prameters for fishery regulations. Whatever be the factors studied, so long as effort is the one parameter which is amenable to physical control, the results accruing from any study should be capable of being translated to details of catch and effort. Hence, any study making use of historic data on catch and effort will receive positive premium.

Logically, the gearwise catch and effort data form the base of the present study. On a macrolevel, the data in Table 1 form the broad base of the study. At the microlevel, the data utilised consist of the statewise, gearwise catch, effort and CPUE, which are further split between the pelagics and demersals. Trawlers, purseseiners, gillnetters, bagnetters, dolnetters, other mechanised units (mainly hooks & line), motorised craft operating boatseines, ringseines, gillnets, dolnets and others and finally the traditional nonmechanised craft are separately considered in the first phase.

In the second phase the weighted CPUEs for the pelagic and demersal groups have been arrived at separately as indicated below.

The weighted CPUE (pelagic) =

$$\frac{(134497 \times 83 + 117341 \times 2170 + \ldots + 306666 \times 35)}{134497 + 15188 + \ldots\ldots + 97779} = 403$$

and the weighted CPUE (demersal) =

$$\frac{(509384 \times 313 + 15188 \times 281 + \ldots\ldots + 97779 \times 11)}{509384 + 15188 + \ldots\ldots + 97779} = 248$$

TABLE 1. *Trend in catch and effort of major fishing units in India during 1985-'96 (catch in tonnes, effort in boatdays and CPUE in kg)*

		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
MTN	Catch	556571	643881	752386	763673	729718	850125	952422	1056964	1080664	1251278	1129395	1226030
	Effort	1444604	1629098	1980971	2112104	1655701	1715211	1827405	1858717	2019665	2190596	2004995	1853567
	CPUE	385	395	380	362	441	496	521	569	535	571	563	661
Relative	Catch		15.69	16.85	1.50	—4.45	16.50	12.03	10.98	2.24	15.79	—9.74	8.56
growth (%)	Effort		12.77	21.60	6.62	—21.61	3.59	6.54	1.71	8.66	8.46	—8.47	—7.55
	CPUE		2.59	—3.90	—4.80	21.89	12.46	5.15	9.11	—5.91	6.75	—1.39	17.42
MPS	Catch	103098	132529	135836	178200	286616	183100	163559	163236	194955	115879	117705	149126
	Effort	56121	54086	74514	81719	125972	102559	101213	92607	95733	67804	71467	100655
	CPUE	1837	2450	1823	2181	2275	1785	1616	1763	2036	1709	1647	1482
Relative	Catch		28.55	2.50	31.19	60.84	—36.12	—10.67	—0.20	19.43	—40.56	1.58	26.69
growth (%)	Effort		—3.63	37.77	9.67	54.15	—18.59	—1.31	—8.50	3.38	—29.17	5.40	40.84
	CPUE		33.38	—25.60	19.62	4.34	—21.53	—9.48	9.08	15.53	—16.08	—3.63	—10.04
MGN	Catch	107891	103539	125783	124396	129174	93523	140547	98904	100508	96982	152652	115558
	Effort	774835	1005109	1221912	1422817	898419	674023	961592	682884	573141	659675	1672996	946643
	CPUE	139	103	103	87	144	139	146	145	175	147	91	122
Relative	Catch		—4.03	21.48	—1.10	3.84	—27.60	50.28	—29.63	1.62	—3.51	57.40	—24.30
growth (%)	Effort		29.72	21.57	16.44	—36.86	—24.98	42.66	—28.98	—16.07	15.10	153.61	—43.42
	CPUE		—26.02	—0.07	—15.07	64.45	—3.50	5.34	—0.91	21.08	—16.17	—37.94	33.78
MBN	Catch	234095	199367	137782	116107	183099	203814	220427	145869	128949	140504	93720	149018
	Effort	508838	326810	302849	314784	405145	376974	362896	199879	216280	211833	158433	333244
	CPUE	460	610	455	369	452	541	607	730	596	663	592	447
Relative	Catch		—14.84	—30.89	—15.73	57.70	11.31	8.15	—33.82	—11.60	9.96	—33.30	59.00
growth (%)	Effort		—35.77	—7.33	3.94	28.71	—6.95	—3.73	—44.92	8.21	—2.06	—25.21	110.34
	CPUE		32.60	—25.42	—18.93	22.53	19.63	12.35	20.15	—18.30	11.25	—10.82	—24.41

OBBS	Catch	92002	1188433	48416	87800	51705	42176	24973	19187	15002	13856	14021	38918
	Effort	203640	329713	170680	196178	97678	69036	53439	37485	61560	52534	48519	99641
	CPUE	452	359	284	448	529	611	467	512	244	264	289	391
Relative	Catch		28.73	—59.12	81.35	—41.11	—18.43	—40.79	—23.17	—21.81	—7.64	1.19	177.57
growth (%)	Effort		61.91	—48.23	14.94	—50.21	—29.32	—22.59	—29.85	64.23	—14.66	—7.64	105.36
	CPUE		—20.49	—21.03	57.77	18.27	15.41	—23.51	9.53	—52.39	8.23	9.56	35.16
OBGN	Catch	23504	34263	21074	36794	72421	88481	89512	98622	133004	159053	96703	171271
	Effort	352098	467281	318073	510626	926496	1012930	1090464	1105604	1705992	2065080	1202484	2776394
	CPUE	67	73	66	72	78	87	82	89	78	77	80	62
Relative	Catch		45.78	—38.49	74.59	96.83	22.18	1.17	10.18	34.86	19.58	—39.20	77.11
growth (%)	Effort		32.71	—31.93	60.54	81.44	9.33	7.65	1.39	54.30	21.05	—41.77	130.89
	CPUE		9.84	—9.64	8.76	8.48	11.75	—6.03	8.67	—12.60	—1.21	4.41	—23.29
OBRS	Catch	0	22498	31558	85146	279980	269941	227834	201616	162710	160133	219041	183882
	Effort	0	29106	80364	137038	340209	251103	281943	262855	281850	229170	204049	240277
	CPUE	0	773	393	621	823	1075	808	767	577	699	1073	765
Relative	Catch			40.27	169.81	228.82	—3.59	—15.60	—11.51	—19.30	—1.58	36.79	—16.05
growth (%)	Effort			176.11	70.52	148.26	—26.19	12.28	—6.77	7.23	—18.69	—10.96	17.75
	CPUE		0	—49.20	58.23	32.45	30.63	—24.83	—5.08	—24.74	21.04	53.63	—28.71
NM	Catch	389165	404445	373303	351348	407535	361801	364793	359751	315098	314497	274657	279980
	Effort	1021695	8801921	9065681	1085207	8053393	7752961	7420431	6950056	6553056	5813378	5390018	4678579
	CPUE	38	46	41	32	51	47	49	52	48	54	51	60
Relative	Catch		3.93	—7.70	—5.88	15.99	—11.22	0.83	—1.38	—12.41	-0.19	—12.67	1.94
growth (%)	Effort		—13.85	3.00	19.70	—25.79	—3.73	—4.29	—6.34	—5.71	—11.29	—7.28	—13.20
	CPUE		20.63	—10.39	—21.37	56.30	—7.78	5.35	5.29	—7.11	12.51	—5.81	17.44

(MTN = mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gillnetter; MBN = mechanised bagnetter; OBBS = outboard motorised boatseiner; OBGN = outboard motorised gillnetter; OBRS = outboard motorised ring seiner; NM = nonmechanised units).

TABLE 2. *The total catch and CPUE for the 1986 pelagic fisheries by fishing tackles*

Gear	Catch (t)		CPUE (kg)	
	Pelagic	Demersal	Pelagic	Demersal
Trawler (mechanised)	1,34,497	509,384	83	313
Purseseiner (mechanised)	1,17,341	15,188	2,170	281
Gillnetter (mechanised)	78,419	25,120	78	25
Bagnetter (mechanised)	953	379	243	97
Dolnetter (mechanised)	1,10,300	87,735	342	272
Others (mechanised)	6,541	2,789	64	27
Boatseine (motorised)	92,651	25,782	281	78
Gillnet (motorised)	31,350	2,913	67	6
Ringseine (motorised)	21,623	875	743	30
Dolnet (motorised)	0	0	0	0
Others (motorised)	5,352	5,736	48	52
Nonmechanised	3,06,666	97,779	35	11
Total	9,05,693	7,73,680	4,154	1,192

The weighted CPUEs for the pelagic and demersal groups have thus been arrived at for the years 1986 to 1996 (Table 3).

The standardised effort (SF) has been obtained as follows:

SF=Landings / weighted CPUE x 1000 (since unit of CPUE is kg)

Thus, for 1986,

SF(P) = 905693 / 403 x 1000 = 2245667

SF(D) = 773680 / 248 x 1000 = 3124724

where 9,05,693 and 7,73,680 are the total landings of pelagic and demersal groups in tonnes separately. The standard efforts so obtained are given in Table 3. A response curve, fitted to the total catch against the standard effort, of the form $y = af - bf^2$, forcing through the origin, gives the following estimates of maximum sustainable yield (MSY).

MSY (P) = 1215899

MSY (D) = 961485

The data on the average landings (pelagics and demersal) in the various maritime states during 1992-'96 are provided in Tables 4 & 5. The expected MSY values for the different fishing fleets in different states have been obtained by projecting the current average to the MSY. Thus in Table 6 the MSY of 3,858 for the trawl fleet in West Bengal has been derived as follows.

3,858=3,807 x 12,15,899 / 11,99,877, where the figure 1,19,987 denotes the average annual pelagic landings in tonnes.

Similarly the expected MSY values for all the fleets (gear) for all the states in respect of both pelagic and demersal resources have been obtained. The results are given in Tables 6 and 7.

TABLE 3. *Weighted CPUEs and standard effort*

Year	Total		Weighted CPUE		Standard effort	
	Pelagic	Demersal	Pelagic	Demersal	Pelagic	Demersal
1986	9,05,693	7,73,680	403	248	22,45,667	31,24,724
1987	8,44,310	8,04,855	364	247	23,22,644	32,57,798
1988	9,83,766	8,01,783	480	219	20,49,957	36,60,770
1989	13,93,617	8,14,981	649	251	21,46,999	32,52,139
1990	12,48,570	8,94,143	557	298	22,41,188	30,02,895
1991	12,45,611	9,76,500	431	322	28,89,532	30,32,933
1992	12,42,081	10,70,144	386	349	31,68,576	30,15,729
1993	12,09,430	10,61,922	450	331	26,59,161	31,68,073
1994	11,32,008	12,09,013	312	353	36,01,011	34,05,318
1995	11,46,718	10,27,369	356	312	33,00,821	33,67,231
1996	12,47,476	10,74,891	344	337	37,26,407	32,81,097

TABLE 4. *Estimated landings during 1992-'96 (pelagic)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	3,807	0	911	15,008	1,442	0	29,098	0	0	0	6,948	57,213
Orissa	6,612	0	2,799	0	8,845	0	178	0	0	674	6,305	25,413
Andhra Pradesh	21,465	0	6,088	0	338	111	8,107	0	0	8,935	57,637	1,02,681
Tamil Nadu	67,181	0	14,564	299	4,605	1,912	26,704	0	0	9,850	78,514	2,03,630
Pondicherry	345	0	474	751	20	0	1,506	0	0	1,093	6,391	10,579
Kerala	70,615	6,390	1,442	0	303	14,151	34,653	1,71,915	0	11,958	21,031	3,32,457
Karnataka	17,785	61,886	308	0	1	0	6,718	1,072	0	2,723	3,889	94,384
Goa	3,042	40,951	360	0	126	0	2,391	0	0	220	800	47,890
Maharashtra	61,202	36,653	10,578	18,552	1,086	0	3,669	0	13	794	2,033	1,34,578
Gujarat	65,163	0	12,963	70,377	3,886	0	33,421	0	712	0	4,529	1,91,051

TABLE 5. *Average landings during 1992-'96 (demersal)*

State/Gear	MTN	MPS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	6,849	0	604	3930	258	0	5,176	0	0	0	3,613	20,430
Orissa	19,861	0	855	0	2989	0	31	0	0	474	1,801	26,011
Andhra Pradesh	38,667	0	1297	0	102	20	1,057	0	0	1,847	16,109	59,099
Tamil Nadu	1,61,874	0	2459	14	1577	65	7,390	0	0	2,031	20,503	1,95,913
Pondicherry	2,587	0	19	0	1	0	142	0	0	56	1,027	3,832
Kerala	2,00,019	96	66	0	546	3223	2,753	13,863	0	15,542	5,158	2,41,267
Karnataka	58,379	1224	118	0	5	31	198	771	0	1,226	1,943	63,895
Goa	24,167	1204	42	0	62	0	311	0	0	39	391	26,216
Maharashtra	1,58,981	4199	2825	26135	797	0	441	0	4	1,818	1,395	1,96,594
Gujarat	2,02,987	0	7387	28249	3423	0	10,846	0	221	0	5,855	2,58,967

(MOTHS = other motorised boats; OBDOL = outboard motorised dol netter; OBOTHS = other outboard motorised boats; MTN= mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gill netter; MBN = mechanised bag netter; OBBS = outboard motorised boat seiner; OBGN = outboard motorised gill netter; OBRS = outboard motorised ring seiner; NM = nonmechanised units).

TABLE 6. *Estimated maximum sustainable yield (pelagic)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	3,858	0	923	15,208	1,461	0	29,487	0	0	0	7,041	57,977
Orissa	6,701	0	2,836	0	8,963	0	180	0	0	683	6,389	25,752
Andhra Pradesh	21,751	0	6,169	0	343	112	8,215	0	0	9,055	58,407	1,04,052
Tamil Nadu	68,079	0	14,759	303	4,667	1,937	27,061	0	0	9,981	79,563	2,06,349
Pondicherry	349	0	480	761	20	0	1,527	0	0	1,107	6,476	10,720
Kerala	71,558	6,475	1,461	0	307	14,340	35,116	1,74,211	0	12,118	21,312	3,36,897
Karnataka	18,023	62,713	312	0	1	0	6,808	10,86	0	2,759	3,941	95,644
Goa	3,083	41,498	365	0	127	0	2,423	0	0	223	810	48,530
Maharashtra	62,019	37,143	10,719	18,799	1,101	0	3,718	0	13	804	2,060	1,36,375
Gujarat	66,034	0	13,136	71,316	3,938	0	33,867	0	722	0	4,590	1,93,602
Total	3,21,454	1,47,828	51,161	1,06,388	20,929	16,389	1,48,401	1,75,297	734	36,730	1,90,588	12,15,899

TABLE 7. *Estimated maximum sustainable yield (demersal)*

State/Gear	MTN	PN	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	6,029	0	532	3,459	227	0	4,556	0	0	0	3,181	17,984
Orissa	17,484	0	752	0	2,631	0	28	0	0	417	1,586	22,898
Andhra Pradesh	34,039	0	1,142	0	90	17	930	0	0	1,626	14,181	52,025
Tamil Nadu	1,42,498	0	2,165	12	1,388	57	6,506	0	0	1,788	18,048	1,72,462
Pondicherry	2,277	0	17	0	1	0	125	0	0	50	904	3,373
Kerala	1,76,077	84	58	0	481	2,838	2,424	12,203	0	13,682	4,541	2,12,387
Karnataka	51,391	1,078	104	0	5	27	175	679	0	1,079	1,711	56,247
Goa	21,275	1,060	37	0	54	0	273	0	0	34	344	23,078
Maharashtra	1,39,951	3,696	2,487	23,007	702	0	388	0	3	1,600	1,228	1,73,062
Gujarat	1,78,689	0	6,503	24,867	3,013	0	9,548	0	195	0	5,154	2,27,968
Total	7,69,709	5,918	13,795	51,346	8,592	2,939	24,953	12,882	198	20,277	50,877	9,61,485

(MOTHS = other motorised boats; OBDOL = outboard motorised dol netter; OBOTHS = other outboard motorised boats; MTN = mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gill netter; MBN = mechanised bag netter; OBBS = outboard motorised boat seiner; OBGN = outboard motorised gill netter; OBRS = outboard motorised ring seiner; NM nonmechanised units).

TABLE 8. *Average catch per unit effort during 1992-'96 (pelagic)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM
West Bengal	266	0	541	551	132	0	417	0	0	0	92
Orissa	92	0	54	0	91	0	29	0	0	33	21
Andhra Pradesh	202	0	79	0	135	135	67	0	0	284	36
Tamil Nadu	118	0	57	295	43	105	46	0	0	56	33
Pondicherry	30	0	49	349	24	0	32	0	0	133	28
Kerala	121	1,952	134	0	94	343	57	733	0	30	22
Karnataka	95	1,465	156	0	13	1	120	124	0	163	60
Goa	62	1,259	75	0	504	0	52	0	0	56	57
Maharashtra	209	2,349	126	145	68	0	43	0	12	30	26
Gujarat	234	0	203	488	552	0	95	0	26	0	36

TABLE 9. *Average catch per unit effort during 1992-'96 (demersal)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM
West Bengal	428	0	391	143	24	0	74	0	0	0	50
Orissa	251	0	13	0	26	0	3	0	0	20	6
Andhra Pradesh	371	0	18	0	39	37	10	0	0	39	10
Tamil Nadu	293	0	11	4	19	4	10	0	0	16	9
Pondicherry	193	0	2	0	1	0	3	0	0	24	4
Kerala	347	28	6	0	197	72	5	58	0	41	5
Karnataka	312	30	39	0	51	102	4	92	0	83	34
Goa	474	45	6	0	78	0	5	0	0	8	28
Maharashtra	559	284	37	199	72	0	5	0	4	75	19
Gujarat	689	0	94	152	519	0	24	0	7	0	38

(MOTHS = other motorised boats; OBDOL = outboard motorised dol netter; OBOTHS = other outboard motorised boats; MTN = mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gill netter; MBN = mechanised bag netter; OBBS = outboard motorised boat seiner; OBGN = outboard motorised gill netter; OBRS = outboard motorised ring seiner; NM nonmechanised units).

TABLE 10. *Estimated MSY effort (pelagic)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	14,486	0	1,706	27,611	11,070	0	70,711	0	0	0	76,697	0
Orissa	72,498	0	52,086	0	98,652	0	6,300	0	0	20,588	2,98,358	0
Andhra Pradesh	1,07,651	0	78,503	0	2,532	834	1,23,033	0	0	31,836	16,32,604	1,10,956
Tamil Nadu	5,75,280	0	2,59,267	1,027	1,09,679	18,432	5,88,282	0	0	1,79,410	24,40,826	58,996
Pondicherry	11,696	0	9,750	2,180	848	0	47,815	0	0	8,334	2,29,492	0
Kerala	5,90,841	3,317	10,873	0	3,265	41,855	6,17,966	2,37,623	0	4,06,876	9,83,569	0
Karnataka	1,89,672	42,801	2,002	0	110	311	56,630	8,732	0	16,969	65,978	11,78,791
Goa	49,327	32,951	4,886	0	253	0	46,586	0	0	3,989	14,181	0
Maharashtra	2,96,967	15,814	85,259	1,29,337	16,088	0	85,897	0	1,082	26,783	77,747	0
Gujarat	2,82,195	0	64,709	1,46,157	7,134	0	356,496	0	28,247	0	127,492	0
Total	21,90,613	94,883	569,041	3,06,313	2,49,631	61,432	19,99,718	2,46,355	29,329	6,94,786	59,46,942	13,48,744

TABLE 11. *Estimated MSY effort (demersal)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	14098	0	1361	24274	9463	0	61573	0	0	0	63599	0
Orissa	69700	0	58419	0	101963	0	8445	0	0	20998	277828	0
Andhra Pradesh	91864	0	61956	0	2297	470	90296	0	0	41985	1375762	99250
Tamil Nadu	486764	0	196858	2881	71608	15532	650578	0	0	115001	2056834	349828
Pondicherry	11785	0	9623	0	822	0	40306	0	0	2068	225956	0
Kerala	507720	2987	9451	0	2437	39250	513311	211194	0	335855	860379	0
Karnataka	164710	36441	2648	0	93	263	43789	7374	0	13018	50693	1153192
Goa	44849	23382	6539	0	691	0	52974	0	0	4198	12391	0
Maharashtra	250506	13021	66527	115826	9775	0	70696	0	912	21308	65223	0
Gujarat	259346	0	69176	163930	5806	0	398416	0	28855	0	135630	0
Total	1901341	75831	482559	306912	204957	55515	1930385	218569	29767	554431	5124294	1602270

(MOTHS = other motorised boats; OBDOL = outboard motorised dol netter; OBOTHS = other outboard motorised boats; MTN = mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gill netter; MBN = mechanised bag netter; OBBS = outboard motorised boat seiner; OBGN = outboard motorised gill netter; OBRS = outboard motorised ring seiner; NM nonmechanised units).

TABLE 12. *Estimated effort (in boatdays)*

State/Gear	MTN	PS	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTH	NM	Total
West Bengal	14,247	0	1,562	2,6925	10,823	0	69,334	0	0	0	72,078	0
Orissa	70,453	0	53,297	0	99,385	0	6,521	0	0	20,742	2,94,038	0
Andhra Pradesh	97,435	0	75,359	0	2,479	756	1,18,657	0	0	33,052	15,75,155	1,06,759
Tamil Nadu	5,12,245	0	2,49,164	1,054	97,761	18,334	5,99,406	0	0	1,65,342	23,59,381	94,925
Pondicherry	11,773	0	9,746	2,180	847	0	47,150	0	0	7,375	2,29,053	0
Kerala	5,29,235	3,312	10,811	0	2,705	41,401	6,09,937	2,35,693	0	3,65,849	9,59,441	0
Karnataka	1,70,537	42,675	2,131	0	97	263	56,218	8,155	0	15,635	60,460	11,69,180
Goa	45,371	32,619	5,003	0	312	0	47,163	0	0	4,016	13,596	0
Maharashtra	2,63,148	15,513	80,966	1,21,535	12,855	0	84,187	0	1,042	22,872	72,543	0
Gujarat	2,65,139	0	66,123	1,50,372	6,490	0	3,64,940	0	28,374	0	1,31,671	0
Total	19,79,582	94,119	5,54,162	3,02,067	2,33,753	60,754	20,03,512	2,43,847	29,416	6,34,882	57,67,415	13,70,864

TABLE 13. *Estimated optimum fleet (in boats or units)*

State/Gear	MTN	PN	MGN	MBN	MOTHS	OBBS	OBGN	OBRS	OBDOL	OBOTHS	NM	Total
West Bengal	79	0	10	179	72	0	347	0	0	0	360	1,048
Orissa	391	0	355	0	663	0	33	0	0	104	1,470	3,016
Andhra Pradesh	541	0	502	0	17	4	593	0	0	165	7,876	9,698
Tamil Nnadu	2,846	0	1,661	7	652	92	2,997	0	0	827	11,797	20,878
Pondicherry	65	0	65	15	6	0	236	0	0	37	1,145	1,568
Kerala	2,940	28	72	0	18	207	3,050	1,178	0	1,829	4,797	14,119
Karnataka	947	356	14	0	1	1	281	41	0	78	302	2,022
Goa	252	272	33	0	2	0	236	0	0	20	68	883
Maharashtra	1,462	129	540	810	86	0	421	0	5	114	363	3,930
Gujarat	1,473	0	441	1,002	43	0	1,825	0	142	0	658	5,584
Total	10,998	784	3,694	2,014	1,558	304	10,018	1,219	147	3,174	28,837	62,748

(MOTHS = other motorised boats; OBDOL = outboard motorised dol netter; OBOTHS = other outboard motorised boats; MTN = mechanised trawler; MPS = mechanised purse seiner; MGN = mechanised gill netter; MBN = mechanised bag netter; OBBS = outboard motorised boat seiner; OBGN = outboard motorised gill netter; OBRS = outboard motorised ring seiner; NM nonmechanised units).

Table 8 and 9 give the average CPUEs (average for 1992 to 1996) for the pelagics and demersals separately.

The expected efforts corresponding to the MSY estimates have been derived by dividing the MSY by the current CPUE. Thus the MSY effort for MTN for West Bengal for the pelagic fish has been found to be 3,858/266 x 1000 = 14,486 boatdays.

Similarly the MSY effort in respect of all the states have been arrived at and are shown in Tables 10 and 11.

Thus two estimates of MSY efforts have been obtained from which the weighted MSY effort has been arrived at by obtaining a weighted average of these estimates. Thus the final estimate of MSY effort for the trawl fleet in West Bengal has been obtained as:

Effort (MSY) = (14,486 x 266 + 14,098 x 428) / (266 + 428)

Similar effort (MSY) values have been the fleets obtained for all (gears) statewise as given in Table 12.

The optimum fleet size (in number of boats or units) has been obtained by dividing the effort (MSY) by the expected number of operations (fishing days) in a year (Table 13).

Limitations

- No estimates have been possible for the island territories of the Andamans and the Lakshadweep as the Institute has no detailed information on gearwise production in these areas.
- In the absence of required economic indicators it is not possible to make a realistic assessment of the actual fleet size that the fishery can sustain. The estimates presented here, to that extent, would mean the fleet required to be operated per day of fishing. However, the effort given in Table 12 can be taken as a reference point for managing the fisheries.
- Estimates are subject to the assumption that the present dispensation would continue for some more time. However, experience shows that changes do occur very fast. For example, purse seine was not in operation in Maharashtra some six years ago. In Kerala, boat seine which was the main tackle in the traditional sector is getting replaced fast by ringseines. The operational efficiency of ringseine is increasing day by day. Long voyages and multiday operations are quite popular with the trawlers in some parts of the country. Perhaps, this phenomenon may change the entire structure of trawling operations in the country.
- A sizable proportion of production from the artisanal sector comes from Tamil Nadu and Andhra Pradesh. Hence it was felt that the estimates in respect of the nonmechanised units in these two states needed further investigation. However, the difference of such estimates from the estimates in Table 13 is negligible.

As mentioned above, the determination of the optimum fleet size is beset with the problem of changes in fishing practices. This is more conspicuous in view of the rapid motorization of the traditional fishing craft. Motorization of traditional craft has led to, in many maritime states, fabrication of nets that are more efficient than the erstwhile ones. Table 14 gives the replacement ratios for the purse seine and ring seine fleets in Kerala and Karnataka in terms of the major traditional gear.

TABLE 14. *Replacement ratios*

State	Gear	OBBS	OBGN	OBRS	NM
Kerala	Purse seine	4.8	32.2	2.5	73.5
	Ring seine	1.9	12.9	-	29.4
Karnataka	Purse seine	14.5	12.0	6.9	16.0
	Ring seine	2.1	1.7	-	2.3

This would mean that a purse seine in Kerala effectively replaces 4.8 OBBS, 32,2 OBGN, 2.5 OBRS and 73.5 NM units, and so on. The socioeconomic implication of such replacement schedule, as has been happening in the southwest coast of India, is quite formidable and alarming.

941 'MARINEFISH-FAMINE'(?) IN KARNATAKA WITH PARTICULAR REFERENCE TO UDUPI DISTRICT DURING 1998-'99

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'Marinefish-famine' is an issue often raised by the fishermen of Karnataka over the past several years whenever, they are affected mone tarily and there is a failure of major fisheries of the region like mackerel and oil sardine and the high-value resources like cuttlefishes, squids and prawns. In the beginning of the fishing season, September-October 1998, the machanised sector complained of fish famine as they could not get the expected quantity of certain high priced fish varieties which they harvested in bountiful and got appreciable monetary benefit during the previous season. Because of this the fishermen's cry of 'fish famine' was little more pronounced during 1998.

During the decadal period of 1988-'97 the annual marine fish production of Karnataka varied between 1,42,369 t in 1993 and 2,51,012 t in 1989 with an annual average of 1,76,506 t (Table 1) (CMFRI). The production of 1,64,710 t in 1998 was 6.7% and 14.9% less than the average for the above 10 year period and the first five-year period (1988-'92) respectively, but 3.2% higher than the second five-year period of 1993-'97. The annual fluctuation in marine fish production of the state, as compared to the previous year during the last decade, varied from (—) 29% in 1990 (as compared to the previous year, 1989) to (+) 59.5% in 1986 (as compared to 1985). The decrease of 12.3%) in production in 1998 as compared to 1997 is a normal fluctuation. However, the study on the landings of different categories of fish groups shows, (Table 2) that decline of high value fish resources like cephalopods (36.3%, — 4,345 t), ribbonfishes (65.7%—5,186 t), prawns (33.3%, — 3,290 t), mackerel (25.0%, — 10,848 t) etc., had led to the loss of Rs.94.5 crores to the fishermen of Karnataka during 1998 as compared to 1997. The production deficit of 111 t of prawns, 4,352 t of mackerel and 1,700 t of cephalopods during September-October of 1998 in the Mangalore-Malpe area as compared to 1997 has resulted in a loss of Rs.19.4 crores to marine fishery sector. The fishermen had expected to harvest these high value resources similar to the same level as in the corresponding period of the previous year. Nevertheless, the reduced availability of these resources in 1998 especially during September-October made the fishermen to incur loss. This had led the fishermen to put forward several reasons as the causes for the production deficit in 1998 and finally to self-declare the year as 'fish famine' affected.

TABLE 1. *Marine fish landings in Karnataka during 1988-'98*

Year	Catch (tonnes)	+/— compared to previous year (%)
1988	2,12,411	—3.7
1989	2,51,012	18.2
1990	1,78,334	—29.0
1991	1,56,654	—12.2
1992	1,68,810	7.8
1993	1,42,369	—15.7
1994	1,49,699	5.1
1995	1,48,941	—0.5
1996	1,69,068	13.5
1997	1,87,758	11.1
1998	1,64,710	—12.3

TABLE 2. *Specieswise marine fish landings (tonnes) in Karnataka during 1997 and 1998*

Name of fish	1997	1998	Difference
Elasmobranchs	812	1,602	790
Catfishes	107	170	63
Oil sardine	9,854	13,944	4,090
Other sardines	8,122	7,721	—401
Anchovies	8,766	8,540	—226
Other clupeoids	1,568	3,592	2,024
Croakers	3,137	3,921	784
Whitefish	1,033	1,585	552
Flatfishes	8,619	6,531	—2,088
Threadfin breams	11,389	13,359	1,970
Ribbonfishes	7,890	2,704	—5,186
Carangids	16,893	16,234	—659
Silverbellies	1,654	2,514	860
Pomfrets	1,433	1,355	—78
Mackerel	43,466	32,618	—10,848
Seerfishes	2,491	2,160	—331
Tunas & billfishes	2,168	3,623	1,455
Prawns	9,890	6,600	—3,290
Crabs	2,296	797	—1,499
Squilla	20,587	12,435	—8,152
Cephalopods	11,977	7,632	—4,345
Lizardfishes	2,468	3,929	1,461
Barracudas	785	2,002	1,217
Groupers	2,125	1,836	—289
Goatfishes	3	34	31
Other perches	5,954	5,053	—901
Wolf-herrings	460	202	—258
Other fishes	1,811	2,017	206
Total	1,87,758	1,64,710	—23,048

'Fish famine'- Situation in Udupi District

There are 31 fish landing centres/fishing villages in the Udupi district starting from Mulki-Hejmadi-Kodi in the south to Kesar Kodi in the north. According to the Rapid Assessment Survey of Craft and Gear conducted by CMFRI during 1998 there are 1,051 mechanised vessels, 1,225 motorised boats and 914 non-motorised boats engaged in marine fishing along the 100 km length coast line of the district. The mechanised vessels employ trawl and/purse seine during September-May period whereas, the motorised and non-motorised boats operate gillnet for larger species during September-May or gillnet/ring seines (*'matubale'* and *'ranibale'*), castnet, hand-trawl and longline for smaller fishes during the monsoon season (June-August). As the Udupi district has been recently formed by bifurcating the former Dakshina Kannada district, at present there is no separate fishery catch statistics available for the district. Nevertheless, the study of marine fish production at the Malpe Fisheries Harbour (MFH) and that of the former Dakshina Kannada District which together contribute about 59% of the marine fish production of the state would give a fairly reasonable picture of fishery scenario of the Udupi district during the 'fish famine' year 1998-'99.

Malpe Fisheries Harbour commissioned during 1986-'87 is an all weather fishing port and at present provides landing facilities for 775 mechanised vessels (73.7% of the district's total number of mechanised vessels) and 235 motorised boats (19% of the district's total number of motorised boats).

The annual marine fish production at MFH during the decadal period of 1988/'89-1997/'98, oscillated from 19,601 t (1995-'96) to 55,906 t (1989-'90) with an annual average of 34,526 t (Table 3). During this period the decrease in production in different years varied from 5.8% (1995-'96) to 40.9% (1990-'91) and the increase from 7.2% (1988-'89) to 98.9% (1996-'97). This shows that the annual production at MFH fluctuated widely similar to that observed in the all-India or Karnataka marine fish landings. The average annual production during the first five-year period (1988/'89-'92/'93) was 39,192 t, which decreased to 29,860 t during the next five-year period (1993/'94-'97/'98). The production of 34,661 t during the 'fish famine' af-

fected year of 1998-'99 was 0.4% (135 t) and 16.1% (4,801 t) higher than the average of the decadal period and second the five-year period 1993/'94-1997/'98 respectively. However, when, compared to the first five-year period (1988/'89-1992/'93) the landing in 1998-'99 was less by 11.6% (4,531 t). Also when compared to the previous year (1997-'98), which recorded the second peak landing of 50,558 t ever after the commissioning of the port in 1987, the landing in 1998-'99 has dropped substantially by 31.4% (15,897 t). Similar trend was observed at MFH during 1989-'90 and 1990-91 (Table 4). The year 1989-'90 witnessed the highest ever-recorded landing of 55,906 t and the following year registered a heavy fall of 40.9% (22, 849 t) in production.

TABLE 3. *Marine fish landings at Malpe Fisheries harbour during 1988/'89 - 1998-'99*

Year	Catch (tonnes)	+/—Compared to previous year (%)
1988-'89	48,492	7.2
1989-'90	55,906	15.3
1990-'91	33,057	—40.9
1991-'92	26,258	—20.6'
1992-'93	32,245	22.8
1993-'94	19,346	—40.0
1994-'95	20,803	7.5
1995-'96	19,601	—5.8
1996-'97	38,992	98.9
1997-'98	50,558	29.7
Average (10 Years)	34,526	
1998'99	34,661	—31.4

Estimated monthwise fish landings by all gear at MFH during 1997-'98 and 1998-'99 are shown in Table 4 and 5. It can be seen that out of 33 fish groups, which support the fishery, only 10 resource groups recorded collectively an increase of 2,408 t during 1998-'99. The rest of 23 resource groups together have registered a decrease of 18,308 t. As the remarkable slump pertained to the commercially important resource groups like cuttle fishes, squids, ribbon fish, prawns etc. the fishermen were economically affected. The production by all gear during 1998-'99 was valued at Rs.5,049.4 lakhs as compared to Rs.7,586.3 lakhs in 1997-'98 (Table 5). Therefore, the loss of income to the owners during 1998-'99 amounted to Rs. 2,536.9 lakhs (33.4%).

The analysis of monthwise marine fish landing during 1993/'94-1998/'99 (Table 6) shows that during 1998-'99, the production declined only during two months June by 199 t and August 89 t is not considerable because, fishing by mechanised vessels was banned during June-August by the Government) October (665 t) and December (1,061 t) as compared to the average monthly catch during the five year period of 1993/'94-1997/'98. But when compared to the previous year (1997-'98) the landing fell short remarkably during eight out of nine fishing months; April (2,933t), May (5,639t), June (759 t), September (1,090 t), October (4,154 t), December (1,764 t), February (632 t) and March (1,475 t). The production decrease varied from 15.4% in September to 60.2% in May (Table 6).

Gearwise scenario

Purse seine fish landings

Eight—five purse seiners are based at MFH and their catch details during the past five years (1993/'94-1997/'98) are given in Table 7. It is seen that the annual catch varied from 6,429 t in '95-'96 to 17,733 t in '96-'97 with an annual average of 10,527 t for an average effort of 6,071 units (boat days) and catch-per-unit-effort (cpue) of 1,734 kg. In 1998-'99 the landing of 12,816 t at a cpue of 2,099 kg for 6,107 units is 21.7% (2,289 t) which is higher than that of the five-year average (10,527 t) and 3% (179 t) more than the previous year (12,437 t). This clearly shows that the purse scine fishery was better during the 'fish-famine' year, 1998-'99.

Though the purse seine landing during 1998-'99 was higher by 3% as compared to last year, the total production value was less by 4.2% (Rs. 68.9 lakhs (Tables 8 and 9). This

TABLE 4. *Estimated marine fish landing (t) by all gear at Malpe Fisheries Harbour during 1997-'98*

Sepcies/Gear	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Total
Elasmobranchs	26.1	57.4	6.8	0.2	0.7	110.4	1.2	13.0	2.9	29.2	29.1	45.2	322.2
Catfishes	3.0	3.1	0	0	0	3.6	0.5	0.5	1.1	1.8	3.6	16.3	33.5
Oilsardine	360.3	187.0	0	0	113.2	1259.2	293.2	119.3	490.1	266.2	147.7	5.8	3242.0
Lesser sardines	1.5	6.1	0	0	6.6	136.2	868.0	198.3	2.6	57.9	4.5	149.0	1430.7
Anchovies	149.5	55.8	3.8	35.8	156.3	323.1	19.5	86.1	133.6	187.6	198.7	356.5	1706.3
Other clupeoids	10.8	5.3	0	10.4	74.7	37.9	45.6	10.5	11.7	25.2	47.1	55.5	334.7
Croakers	44.1	54.9	1.7	3.8	7.7	80.1	21.8	30.2	16.6	47.1	44.1	61.3	413.4
Whitefish	32.5	41.5	1.9	1.2	16.8	29.3	15.7	13.9	6.9	22.0	30.1	71.3	283.1
Flatfishes	242.4	102.4	4.6	4.4	0.4	12.6	85.3	89.9	61.8	97.9	89.8	133.0	924.5
Threadfin breams	838.3	1856.1	62.8	0	0	879.2	591.5	139.2	304.0	416.8	396.9	616.3	6101.1
Ribbonfishes	771.5	1630.3	173.0	1.5	0.2	57.0	1099.9	251.3	42.7	145.4	175.0	234.6	4582.4
Carangids	597.1	738.4	132.1	2.5	19.5	298.7	471.2	312.8	168.7	218.2	199.6	432.6	3591.4
Silverbellies	53.1	61.6	2.9	5.9	27.0	149.2	8.4	25.0	6.1	84.2	122.1	212.0	757.5
Pomfrets	15.4	18.5	2.3	0.1	0.6	7.0	60.0	43.6	15.6	13.5	15.4	10.6	202.6
Mackerel	168.6	351.8	19.9	256.7	63.8	2140.8	3376.3	567.3	176.2	57.3	73.2	94.7	7346.6
Seerfishes	31.9	58.3	4.5	0.2	0.5	32.2	44.9	30.6	11.5	32.2	59.5	104.7	411.0
Tunas & billfishes	7.4	40.0	2.9	0	0	29.0	20.8	6.7	2.4	0.9	5.0	42.2	157.3
Prawns	240.1	133.4	0.5	69.8	197.8	47.8	32.6	108.7	117.4	99.4	127.4	177.6	1352.5
Crabs	50.1	34.4	1.8	1.5	0	6.2	7.6	7.1	22.5	55.9	67.1	72.2	326.4
Squilla	571.7	543.9	9.3	0	0	0	1.8	695.2	763.6	430.1	375.0	392.0	3782.6
Cephalopods	700.7	1853.0	305.3	0	0	990.4	601.4	59.3	142.9	258.2	521.0	899.9	6332.1
Lizardfishes	211.1	342.6	43.9	0	0	34.1	88.1	40.3	47.1	150.3	257.2	815.3	2030.0
Flatheads	28.3	152.8	4.8	0	0	18.3	65.7	30.3	53.5	25.8	123.0	341.8	844.3
Barracudas	9.5	33.9	3.0	0	0	168.2	155.2	24.0	44.5	12.1	36.6	86.4	573.4
Bullseye	332.0	808.1	31.4	0	0	125.6	231.0	41.6	155.8	103.9	107.6	334.2	2271.2
Groupers	52.2	89.4	1.8	0	0	108.6	136.3	25.4	59.4	36.7	33.1	53.6	596.5
Goatfishes	0	0	0	0	0	0	0	0	0	0.1	0.6	0	0.7
Other perches	6.6	1.0	2.5	0	0.2	0	0.1	0.1	0	10.7	31.3	41.7	94.2
Fullbeaks	1.6	0.6	0	0	0	0.9	0.6	1.0	0.5	0.4	0.2	0.5	6.3
Wolf-herrings	5.5	6.8	0	0	0	0	3.5	11.1	2.9	11.9	12.2	5.8	59.7
Other fishes	45.5	97.0	1.7	2.0	0.3	14.4	5.7	17.4	13.7	91.9	66.3	87.0	442.9
Trashfishes	0	0	0	0	0	0	0	5.6	0	0	0	0	5.6
Total	5608.4	9365.4	825.2	396.0	686.3	7100.0	8353.4	3005.3	2878.3	2990.8	2400.0	5949.6	50558.7

TABLE 5. *Estimated marine fish landings (t) by all gear at Malpe Fisheries Harbour during 1998-'99*

Species/Gear	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total	+/—compare to 97-98
Elasmobranchs	0.2	5.2	0.9	0.7	0.1	10.1	8.7	20.5	8.2	6.5	12.4	31.1	104.6	—217.6
Catfishes	0	0.1	0	0	0	2.5	0.8	2.8	0.4	0	0	0.8	7.4	—26.1
Oilsardine	0	34.7	0	3.4	97.8	168.5	51.7	32.0	88.5	340.0	179.7	311.0	1,307.3	—1,934.7
Lesser sardines	52.7	6.5	0	34.6	45.5	85.4	22.1	55.3	228.9	1,118.9	11.4	48.8	1,710.0	279.3
Anchovies	191.4	87.3	1.8	139.0	147.7	21.7	8.0	19.7	36.2	205.6	280.4	412.6	1,551.4	436.9
Other clupeoids	23.4	20.2	0	114.0	121.5	548.6	30.2	47.3	16.4	20.5	17.9	11.2	971.2	636.5
Croakers	24.1	52.2	1.2	35.6	19.6	23.7	45.4	8.5	13.8	63.7	41.1	60.8	389.7	—23.7
Whitefish	34.4	73.5	1.4	37.7	21.5	52.1	4.0	7.7	3.8	20.0	27.7	29.1	312.9	29.8
Flatfishes	89.6	99.6	0	4.1	4.0	153.7	501.5	92.2	28.2	116.2	73.5	138.5	1,301.1	376.6
Threadfin breams	292.7	836.8	4.3	0	1.0	873.9	0	1,493.3	33.0	205.4	635.1	770.7	5,146.2	—954.9
Ribbonfishes	95.6	652.3	6.9	1.8	0.6	3.1	17.3	14.1	31.1	14.0	8.4	64.1	909.3	—3,673.1
Carangids	147.0	190.1	2.5	4.3	0.6	293.0	1,502.0	1,431.0	341.2	116.2	87.9	378.4	4,494.2	902.8
Silverbellies	89.9	39.7	1.1	37.1	15.1	168.4	15.1	28.3	23.5	20.5	21.2	59.3	519.2	—238.3
Pomfrets	1.3	4.9	0	4.1	2.1	60.9	28.2	24.8	4.1	40.0	26.1	17.5	214.0	11.4
Mackerel	92.7	64.9	2.0	182.4	212.9	2,741.8	1,815.6	860.2	21.4	72.9	130.4	110.1	6,307.3	—1,039.3
Seerfishes	28.4	44.0	3.4	1.0	0.6	42.8	41.6	78.4	41.6	22.8	23.0	37.9	365.0	—46.0
Tunas & billfishes	2.0	19.1	9.4	0	0	40.2	24.3	22.8	8.0	1.3	6.7	23.3	157.1	—0.2
Prawns	160.5	130.7	0.6	187.3	3.8	1.7	31.2	11.1	25.2	104.2	148.5	133.6	938.4	—414.1
Crabs	8.7	5.6	0.2	0.5	0.1	0.5	0.2	0.8	1.4	14.8	35.4	35.8	104.0	—222.4
Squilla	440.5	474.2	1.0	0	0	0	0	8.5	47.4	496.7	496.8	780.2	2,745.3	—1037.3
Cephalopods	271.2	328.2	13.8	0	3.5	372.4	2.4	141.7	27.8	228.1	219.5	281.1	1,889.7	—4,442.4
Lizardfishes	255.6	248.7	6.0	0	0	52.1	2.5	59.7	8.0	4.7	59.7	194.7	891.7	—1138.3
Flatheads	31.3	19.0	0	0	0	31.1	3.3	78.8	6.9	3.9	29.7	139.1	343.1	—501.2
Barracudas	48.9	53.8	0	0	0	55.3	5.1	8.4	3.9	9.4	41.6	78.5	304.9	—268.5
Bullseye	206.7	146.8	2.7	0	0	81.4	16.8	200.9	45.1	20.7	61.9	171.2	954.2	—1317.0
Groupers	24.1	48.4	0.8	0	0	94.0	7.2	26.7	7.8	21.6	63.6	91.9	386.1	—210.4
Goatfishes	0	0	0	0	0	0	0	0	0	0	0	0	0	—0.7
Other perches	10.9	0	0	0.1	0	0	2.7	1.0	0.5	1.0	1.7	3.6	21.5	—72.7
Fullbeaks	0	0.6	0.3	0	0	26.1	0.5	1.3	0	0.4	0.8	0.5	30.5	24.2
Wolf-herrings	0	1.8	0	0	0	1.4	0.9	2.7	1.5	20.2	9.3	14.4	52.2	—7.5
Other fishes	51.0	38.5	3.7	0.5	22.3	4.1	10.1	14.1	10.2	14.7	16.4	39.5	225.1	—217.8
Trashfishes	0	0	1.5	0	0	0	0	0	0	0	0	5.8	7.3	1.7
Total	2,674.8	3,727.4	65.5	788.2	720.2	6,010.5	4,198.9	4,794.6	1,114.0	3,324.9	2,767.8	4,475.1	34,661.9	—15,896.8

was due to decreased production of high value varieties like oil sardine by 1,993 t and mackerel by 621 t during September and October.

Thus, the increase in production and cpue in 1988-'99 as compared to the five-year average and the previous year distinctly indicate that during 1998-99 the purse seine fishery has actually improved in terms of quantity of fish landed, but incurred minor economic loss. If the loss (Rs. 68.9 lakh) is shared by 85 purse seiners, then the per boat loss amounted to Rs. 0.8 lakh.

TABLE 6 *Monthwise marine fish production at Malpe Fisheries Harbour by all gear during 1993/'94 - 1998/'99*

Year	1993-'94	1994-'95	1995-'96	1996-'97	1997-'98	Average for 5 years	1998-'99	+/— compared to 5 years average (t)	+/— compared to 5 years average (%)	+/— coapared to '97-'98	+/— coapared to '97-'98 (%)
April	829	2,335	1,478	2,417	5,608	2,473	2,675	202	8.2	—2,933	—52.3
May	759	2,736	1,400	2,610	9,366	3,374	3,727	353	10.5	—5,639	—60.2
June	219	80	61	139	825	265	66	—199	—75.1	—759	—92.0
July	58	132	511	378	396	295	788	493	167.1	392	99.0
August	876	598	703	1,183	686	809	720	—89	—11.0	34	5.0
September	4,500	3,533	4,694	5,260	7,100	5,017	6,010	993	19.8	—1,090	—15.4
October	2,857	2,714	1,270	9,127	8,353	4,864	4,199	—665	—13.7	—4,154	—49.7
November	2,265	3,145	2,031	5,307	3,005	3,151	4,795	1,644	52.2	1,790	59.6
December	2,294	1,606	1,140	2,958	2,878	2,175	1,114	—1,061	—48.8	—1,764	—61.3
January	1,933	1,230	1,909	3,665	2,991	2,346	3,325	979	41.7	334	11.2
February	821	1,207	1,355	3,132	3,400	1,983	2,768	785	39.6	—632	—18.6
March	1,935	1,487	3,049	3,116	5,950	3,107	4,475	1,368	44.0	—1,475	—24.8
Total	19,346	20,803	19,601	38,992	50558	29,859	34,662	4,803	16.1	—15,896	—31.4

TABLE 7. *Gearwise marine fish landings at Malpe Fisheries Harbour during 1993/'94 - 1998/'99*

Year	1993-'94	1994-'95	1995-'96	1996-'97	1997-'98	Average for 5 years	1998-'99
Purse seine							
Catch (t)	9,517	6,519	6,429	17,733	12,437	10,527	12,816
Effort (unit)	5,704	5,142	5,358	7,396	6,753	6,071	6,107
C/E (kg)	1,668	1,268	1,200	2,398	1,842	1,734	2,099
Drift-gillnet							
Catch (t)	344	577	120	374	452	373	519
Effort (unit)	2,702	4,029	1,755	4,044	3,886	3,283	5,276
C/E (kg)	127	143	68	92	116	114	97
Indigenous gear							
Catch (t)	562	692	736	1,198	1,004	838	1,463
Single-day trawl							
Catch (t)	3,652	4,167	2,046	4,860	6,640	4,273	4,884
Effort (unit)	24,458	15,426	17,180	16,802	19,974	18,768	19,026
C/E (kg)	149	270	119	289	332	228	257
Multi-day trawl							
Catch (t)	5,271	9,295	10,270	14,827	30,025	13,938	14,978
Effort (unit)	4,878	6,481	7,920	7,950	8,936	7,233	6,590
C/E (kg)	1,081	1,434	1,297	1,865	3,360	1,927	2,273
Total catch	19,346	21,250	19,601	38,992	50,558	29,949	34,660

TABLE 8. *Gearwise estimated marine fish landing (t) and value (Rs) at Malpe Fisheries Harbour during April '97-March '98*

Species/Gear	Purse seine(t)	value (Rs)	Multi-day trawl (t)	Value (Rs)	Single-day trawl (t)	Value (Rs)	Drift gillnet(t)	Value (Rs)	Indigenous gear (t)	Value (Rs)	Total vaule(RS)
Elasombranchs	45.0	20,27,025	184.9	55,46,820	20.3	4,06,580	70.7	33,94,512	0.9	8,750	11,383,687
Catfishes	0	0	27.0	6,75,775	0.6	87.00	5.9	1.78.410	0	0	8,62.885
Oilsardine	3,195.0	4,79,24,550	2.5	25,200	6.6	1,32,060	0.2	2,790	37.6	5,64,525	4,86,49.125
Lesser sardines	1,403.8	5,61,5048	18.6	93,025	1.6	11,165	0	0	6.6	32.825	57.52,063
Anchovies	81.2	2,43,552	978.4	19,56,882	454.8	13.64,397	0	0	191.9	5.75,934	41.40,765
Other clupeoids	111.8	3,35,496	73.1	2,19,156	64.8	2,59,336	0	0	85.1	3.40,376	11,54,364
Croakers	24.7	3,70,005	198.0	29,70,675	178.8	17,88,370	0.1	710	11.8	1,17,690	52.47,450
Whitefish	1.4	27,900	182.7	27,40,980	81.1	12,15,855	0	0	18.0	2,70,525	42.55,260
Flatfishes	2.0	12,048	132.1	13,21.120	785.0	62,80,376	0	0	5.2	41.960	76,55.504
Tread fim breams	0	0	6,629.5	2,41,18,068	71.5	2,85,820	0	0	0	0	2,44,03,888
Ribbon fish	0	0	3,957.1	4,74,85.560	623.5	93,52,050	0.2	1,600	1.8	14.000	5,68,53,210
Carangids	653.9	19,61,559	2,706.3	81,18,762	203.7	4,07,410	5.4	38,066	22.1	44.108	1,05,69,905
Silverbellies	27.3	5,45,54	371.4	11,14,227	325.8	9,77,457	0	0	33.1	66,102	22.12,340
Pomfrets	53.9	21,57,000	122.6	49,04,120	22.1	7,72,975	3.3	1,47,285	0.7	7,320	79.88,700
Mackerel	6,341.5	9,51,22,575	673.2	1,00,98,720	8.1	1,21,695	7.8	1,16,385	315.8	47.37,510	11.01,96,885
Seerfishes	28.3	11,33,080	215.6	86,22,960	4.0	1,15,075	161.7	97,01,940	0.7	7,260	1.95,80,315
Tunas and billfishes	2.3	23,090	0	0	0	0	155.1	31,02,100	0	0	31,25,190
Prawns	46.9	37,50,240	496.3	4,96,26,900	541.6	2,70,81,700	0	0	267.8	2,14,20,240	10,18,79,080
Crabs	0	0	199.0	995175	125.4	8,77,877	0	0	2.0	9.855	18.82,907
Squilla	0	0	796.0	15,91,928	2,986.8	4.48,0182	0	0	0	0	60.72,110
Cephalopods	2.6	1,04,480	6,273.7	28,23,15,465	55.7	16,71,870	0	0	0	0	28.40,91,815
Lizand fishers	0	0	2,019.5	1,21,17,252	10.5	62,748	0	0	0	0	1,21,80,000
Flatheads	0	0	815.2	44,83,413	29.0	1,45,245	0	0	0.1	480	46.29,138
Barracudas	309.5	15,47,315	245.5	17,18,451	3.4	17,010	15.1	3,01,680	0	0	35,84,456
Bullseye	0	0	2,271.2	90,84,944	0	0	0	0	0	0	90,84,944
Groupers	30.2	90.459	564.1	8,460,900	2.3	18,088	0	0	0	0	85,69,447
Goatfishes	0	0	0.7	2,022	0	0	0	0	0	0	2,022
Other perches	0.1	150	92.9	1,85,876	0.9	2,760	0.2	1,900	0.2	654	1.91,340
Full beaks	1.9	5.820	0	0	0	0	4.3	64,605	0	0	70,425
Wolf-herrings	0	0	57.7	4,33,110	0.9	7,080	1.1	9,008	0	0	4 49 198
Other fishes	74.2	2,22,702	314.1	14,13,266	31.0	92,946	21.0	1,67,792	2.6	7,665	19.04,371
Trahfishes	0	0	5.6	11,186	0	0	0	0	0	0	11,186
Total	12,437.5	16,27,28,648	30,024.5	49,24,51,938	6,640.4	5,79,56,827	452.1	1,72,28,783	1,004.0	2,82,67,779	75,86,33,975
Effort (Unit)	6,753		8,936		19,974		3,886				

TABLE 9. *Gerwise estimated marine fish landing (t) and value (Rs) at Malpe Fisheries Harbour during April '98-March'99*

Species/gear	Purse seine(t)	Value (Rs)	Multi-day trawl (t)	Value (Rs)	Single-day trawl (t)	Value (Rs)	Drift-gillnet (t)	Value (Rs)	Indigenous gear (t)	Value (Rs)	Total value (Rs)
Elasmobranchs	0	0	57.7	20,19,535	3.6	78,672	42.5	21,26,700	0.8	8,100	42,33,007
Catfishes	1.9	37,340	0.9	22,275	0.1	1,365	4.6	1,60,580	0	0	2,21,560
Oilsardine	1202.1	2,40,42,000	3.2	48,165	2.9	57,120	0	0	99.0	19,79,820	2,61,27,105
Lessersardines	1614.8	80,73,975	15.2	91,158	0	0	0	0	79.9	4,79,634	86,44,767
Anchovies	81.6	2,44,590	1060.2	31,20,738	123.8	495324	0	0	285.9	1,43,348	5,00,43,000
Other clupeoids	638.8	19,16,295	58.6	2,05,093	40.8	2,04,095	0	0	233.1	11,65,325	34,90,808
Croakers	71.2	14,23,320	186.9	37,37,420	76.7	9,20,772	0	0	55.0	6,60,060	67,41,572
Whitefish	44.6	8,91,000	133.5	26,69,840	75.6	13,61,178	0	0	59.0	8,85,090	58,07,108
Flatfishes	2.5	15,006	54.0	6,48,444	1237.1	123,70,750	0	0	7.4	73,840	1,31,08,040
Threadfinbreams	0	0	5138.3	30829908	7.8	39,040	0	0	0	0	3,08,68,948
Ribbonfish	10.0	1,50,000	689.8	1,03,46,280	206.9	33,10,912	0.1	1,200	2.4	19,424	1,38,27,816
Carangids	3111.2	93,33,723	1236.5	61,82,735	134.6	3,36,405	7.1	56,488	4.8	11,943	1,59,21,294
Silverbellies	30.8	77,115	132.2	3,96,699	308.0	9,24,081	0	0	48.0	1,20,073	15,17,968
Pomfrets	101.2	50,61,400	90.7	45,35,600	7.2	2,86,680	8.6	431,600	6.2	61,760	1,03,77,,040
Mackerel	5721.3	10,29,83,670	197.5	39,49,660	4.3	86,280	18.8	282,165	365.5	73,09,260	11,46,11,035
Seerfishes	6.5	3,27,450	91.3	45,64,650	1.0	23,825	264.7	1,85,25,570	1.6	16,140	2,34,57,635
Tunas and billfishes	31.1	3,72,996	0	0	0	0	126.0	27,71,516	0	0	31,44,512
Prawns	2.9	2,63,250	302.2	3,77,79,000	442.0	2,65,21,020	0	0	191.1	1,71,96,750	8,17,60,020
Crabs	0	0	45.9	2,75,142	57.6	461,016	0	0	0.6	2,820	7,38,978
Squilla	0	0	624.4	12,48,898	2120.8	42,41,668	0	0	0	0	54,90,566
Cephalopods	0	0	1880.1	10,34,04,785	9.6	3,34,705	0	0	0	0	10,37,39,490
Octopus	0	0	0.8	1,62,480	0.4	41.00	0	0	0	0	1,66,580
Lizardsfishes	0	0	891.7	71,33,888	0	0	0	0	0	0	71,33,888
Flatheads	0	0	334.1	20,04,450	9.0	45,025	0	0	0	0	20,49,475
Barracudas	52.0	2,59,930	230.9	18,46,896	0.6	4,032	21.5	5,37,850	0	0	26,48,708
Bullseye	0	0	954.1	47,70,605	0	0	0	0	0	0	47,70,605
Groupers	0	0	378.4	75,67,700	7.7	76,880	0	0	0	0	76,44,580
Goatfishes	0	0	0	0	0	0	0	0	0	0	0
Other perches	0.7	2,025	20.3	40,582	0.4	1,408	0.2	1,590	0.1	296	45,901
Fullbeaks	25.8	1,03,072	0	0	0	0	4.6	69,375	0	0	1,72,447
Wolf-herrings	0	0	45.7	3,65,760	0.4	3,544	6.1	60,590	0	0	4,29,894
Otherfishes	65.2	2,60,996	108.5	5,42,700	5.4	16,227	14.7	147,240	22.9	68,775	10,35,938
Trashfishes	0	0	7.3	18,350	0	0	0	0	0	0	18,350
Total	12816.2	1,55,83,9153	14970.9	24,05,11,086	4884.3	5,22,06,124	519.5	2,51,72,464	1463.3	3,12,02,458	50,49,49,635
Effort (unit)	6107		6590		19026		5376		-		

Gillnet fish landings

Motorised canoes operate gillnets with mesh-size varying from 65 to 135 mm for exploiting larger species like seerfishes, sharks and rays, tunas and billfishes, catfishes, pomfrets, barracuda, carangids etc., during all months except monsoon period (June-August). The annual landing during the five-year period of 1993/'94-1997/'98 varied from 120 t in 1995-'96 to 577 t in 1994-'95 with an average of 373t (Table 7). The gillnet fishery during 1998-'99 was fairly good with an annual production of 519 t which is 146 t (39.1%) and 67 t (14.8%) higher than the five-yearly average of 373 t and the previous year's (1997-'98) catch of 452 t respectively, However, the cpue has come down from 116 kg in 1997/'98 to '97 kg in 1998-'99. This was owing to more effort put in 1998-'99 i.e., 5,376 units as against 3,886 units in 1997-'98 and the annual average of 3,283 units during 1993/'94-1997/'98.

The gillnet fishermen have earned more economic returns during 1998-'99 as the production was valued at Rs. 251.7 lakhs against Rs.172.3 lakhs during 1997-'98 (Tables 8 and 9).

Indigenous gear fish landings

Indigenous gear fishing is practiced in the Malpe area during the monsoon season (June-August) when the mechanised vessel fishing is banned. Motorised and non-motorised canoes carry out fishing operations with gillnets (*'kanthabale', 'pattabale', 'kotibale'*), ring seines (*'matubale', 'ranibale'*), shore seines, castnet and hand-trawl. The fishery during 1998-'99 has improved over the previous year. The total landing during 1998-'99 was estimated at 1,463 t which is 625 t (74.6%) and 459 t (45.7%) higher than the five-year (1993/'94-1997/'98) annual average landing and that of previous year respectively (Table 7). The income earned from the fishery during 1998-'99 was Rs.3.1 crores against Rs.2.8 crores in the previous year (Tables 8 and 9). Overall, the indigenous gear fishery during the 'fish famine'year 1998-'99 was better than the preceding five years.

Day trawl landings

About 440 trawlers (<12.8 m) are engaged in single-day trawling operations during September-May period. These vessels make 2-3 hauls starting from early morning until noon every day and land their catches in the afternoon/and evening. The annual production during the five-year period 1993/'94-1997/'98 varied from 2,046 t ('95-'96) to 6,640 t ('97-'98) with an average of 4,273 t at a cpue of 228 kg (Table 7). During 1998-'99 the annual production was estimated at 4,884 (cpue 256 kg) which is 14.3% (611 t) higher than the average annual landing for the five year period. However, as compared to previous year's (1997-'98) landing of 6,640 t (cpue 332 kg) there was a decline of 1,756 t (26.4%). The effort of 19,026 units in 1998-'99 was 1.4% more than the average effort for the five-year period but 4.75% less than that of the previous year. The cpue also showed similar trend of an increase during 1998-'99 (256 kg) as compared to the average of the five-year (228 kg) but a decline as compared to the preceding year (332 kg).

The single-day trawl production during 1998-'99 was valued at Rs.522.1 lakhs which is Rs. 57.5 lakhs (9.9%) lower than the previous year figure of Rs.579.6 lakhs (Table 8 and 9). The decrease in monetary return during the year was mainly due to reduced production of export varieties like ribbonfish and high value species like croakers. If the income deficit of Rs. 57.5 lakhs is distributed amongst the 440 boats, the income loss works out to Rs.13,068 per boat.

Multiday trawl landings

In the Udupi district multiday trawl fishing is carried out only from MFH. About 250 trawlers of >12.8 m OAL conduct multiday fishing operations upto 100 m depth area. During the five-year period of 1993/'94-1997/'98 the annual landing by these trawlers ranged from 5,271 t (1993-'94) to 30,025 t (1997-'98) with an average of 13,938 t (Table 7). The cpue varied from 1,081 kg ('93-'94) to 3,360 kg ('97-'98) with an average of 1,927 kg. An estimated 14,978 t of fishes were landed during 1998-'99. As compared with the annual average for the five-year period the production during 1998-'99 was higher by 7.5% (1,040 t). But when compared to the preceding year (1997-'98) when the production by the gear attained a peak of 30,025 t, the landing during the year is less by 50.1% (15,047 t) but comparable to that of 1996-'97. The Cpue of 2,273 kg in 1998-'99 was higher than those of the previous four years (1993/'94-1996/'97) but 32.4% (1,087 kg) lower than that of 1997-'98.

Because of high landings in 1997-'98, the fishermen got more monetary benefit. The production was valued at Rs. 4,924.5 lakhs. However, during 1998-'99 the production value has slumped to Rs. 2,405.3 lakhs thereby, regis-

TABLE 10. *Monthwise marine fish production at Malpe Fisheries Harbour by multi-day trawlers during 1993/ '94 - 1998/'99*

Year		1993-'94	1994-'95	1995-'96	1996-'97	1997-'98	Average for 5 years	1998-'99	+/— compared to 5 years average	+/— compared to '97/'98	Specieswise decrease (t compared to '97/'98
Apr.	Catch (t)	536	1,659	1,180	1,670	4,224	1,854	1,826	—28	—2,398	Threadfin breams (553), Ribbonfish (670),
	Effort (unit)	678	940	1,089	1,085	1,112	981	968	-	-	Cephalopods (428), Carangids (381)
	C/E (kg)	791	1,765	1,084	1,539	3,799	1,890	1,886	-	-	
May	Catch (t)	158	1,872	977	2,174	7,686	2,573	2,681	108	—5,005	Cephalopods (1523), Ribbonfish (726), Bullseye
	Effort (unit)	394	744	956	1,118	1,273	897	1178	-	-	(661), Carangids (445), Mackerel (204)
	C/E (kg)	401	2,516	1,022	1,945	6,038	2,868	2,276	-	-	
Jun.	Catch (t)	0	0	0	0	814	163	51	—112	—763	Cephalopods (291), Ribbonfish (166), Carangids
	Effort (unit)	0	0	0	0	172	34	50	-	-	(130), Threadfin breams (59)
	C/E (kg)	0	0	0	0	4,733	4,794	1,020	-	-	
Aug.	Catch (t)	0	0	98	8	0	21	5	—16	5	
	Effort (unit)	0	0	67	15	0	16	3	-	-	
	C/E (kg)	0	0	1,463	533	0	1,313	1,667	-	-	
Sep.	Catch (t)	0	503	1,534	953	2,214	1,041	1,505	464	—709	Cephalopods (602)
	Effort (unit)	0	266	784	535	619	441	396	-	-	
	C/E (kg)	0	1,891	1,957	1,781	3,577	2,361	3,801	-	-	
Oct.	Catch (t)	33	490	403	2,146	2,969	1,208	72	—1,136	—2,897	Ribbonfish (983), Cephalopods (591), Threadfin
	Effort (unit)	225	345	552	921	1,063	621	138	-	-	breams (591), Bullseye (214),
	C/E (kg)	147	1,420	730	2,330	2,793	1,945	522	-	-	Carangids (204), Groupers (129), Lizardfish (86)
Nov.	Catch (t)	514	994	1,553	990	1,233	1,057	2,341	1,284	1,108	
	Effort (unit)	334	840	991	849	808	764	939	-	-	
	C/E (kg)	1,539	1,183	1,567	1,166	1,526	1,384	2,493	-	-	
Dec.	Catch (t)	1,080	1,116	197	1,427	1,444	1,053	335	—718	—1,109	Threadfine breams (271), Cephalopods (112),
	Effort (unit)	943	809	420	851	645	734	271	-	-	Bullseye (lll), Anchovies (84), Squilla (106),
	C/E (kg)	1,145	1,379	469	1,677	2,239	1,435	1,236	-	-	Praws (64)
Jan.	Catch (t)	1,336	839	1,327	1,571	2,058	1,426	1,145	—281	—913	Threadfin breams (192), Squilla (162),
	Effort (unit)	924	777	1,131	840	769	888	930	-	-	Lizardfish (114), Ribbonfish (122), Bullseye (83)
	C/E (kg)	1,446	1,080	1,173	1,870	2,676	1,606	1,231	-	-	
Feb.	Catch (t)	479	850	992	1,931	2,588	1,368	1,804	436	—784	Cephalopods (297), Lizadfish (197), Ribbonfish
	Effort (unit)	635	773	886	915	934	829	702	-	-	(159), Carangids (99)
	C/E (kg)	754	1,100	1,120	2,110	2,771	1,650	2,570	-	-	
Mar.	Catch (t)	1,137	972	2,010	1,957	4,795	2,174	3,213	1,039	—1,582	Cephalopds 617, Lizadfish (612), Flatheads
	Effort (unit)	745	987	1,044	821	1,541	1,028	1,015	-	-	(187), Bullseye (163), Carangids (105), Seerfish
	C/E (kg)	1,526	985	1,925	2,384	3,112	2,115	3,166	-	-	(72), Praws (67)
Total	Catch (t)	5,273	9,295	10,271	14,827	30,025	13,938	14,978			
	Effort (unit)	4,878	6,481	7,920	7,950	8,936	7,233	6,590			
	C/E (kg)	7,749	13,319	12,510	17,335	33,264	23,361	21,868			

tering about 50% income loss compared to the previous year (Table 8 and 9). If the loss of Rs.2,519.2 lakhs is shared by the 250 multiday trawl boats, the per boat income loss works out to Rs.10.08 lakhs.

Analysis of monthwise catch and catch rate during the five-year of 1993/'94-1997/'98 shows that during 1998-'99 the catch and catch rate were either comparable or higher in five months (April, May, September, November and March) but poor in four months (October, December, January and February). As compared to the previous year (1997-'98), the monthwise total production and the catch rate were low in all the eight out of nine months of fishing operations except November when the landing has almost doubled (Table 10).

Barring anchovies and threadfin breams, all other resources have shown a decline in 1998-'99 resulting in a monetary loss of Rs.25.2 crores to the multiday trawl fishermen. The low production of export varieties like cuttlefishes, squids and ribbonfishes in almost all months, prawns in April, December and May and high value species like groupers in April and October, lizardfishes in May, October, January, February and March, carangids in April, May, October, January and February, bullseyes in April, May, October, December, January and March seerfishes in March, pomfrets in November and December and mackerel in April, May and December contributed to the income deficit (Table 10). The reduction in income was mainly due to low production of cuttle fishes and squids (Rs. 1789.2 lakhs), ribbonfish (Rs. 371.4 lakhs), prawns (Rs. 118.5 lakhs), mackerel (Rs.61.5 lakhs) lizardfishes (Rs. 40.6 lakhs) and sharks and rays (Rs. 35.3 lakhs).

General remarks

The marine fish landing in Karnataka is marked with annual fluctuations akin to the general catch trends of the country. The production of 1,64,710 t in 1998 is less by 12.3% (23,048 t) compared to 1997 but, higher than the average production of 1,59,567 t for 1993-'97. Therefore, this marginal decrease in production in 1998 cannot be considered as any fishfamine condition in the marine fishery sector of the state during 1998.

As far as the fishery situation during 1998-'99 in the Udupi district is concerned, the study on the fish landing at the largest landing centre of the district i.e., Malpe Fisheries Harbour shows that the production during 1998-'99 was normal compared to the past several years but, when compared to the previous year (which was one of the two most productive years since the commssioning of the MFH in 1986-'87 with a record landing of 50,558 t), the landing declined by 31.4% (15,897 t). Similar trend was recorded during 1989-'90 and 1990-'91, when the former recorded a high landing of 55,905 t followed by a 40% (22,849 t) decline in the latter year.

The study also reveals that the purse seine fishing by mechanised vessels was better than the previous year in terms of quantity of fish landed but the income earned during 1998-'99 had dropped marginally by 4.2% compared to 1997-'98. While the gillnet fishing by motorised boats and indigenous gear fishing by motorised and non-motorised boats had shown improvement over the previous years, the trawl fisheries by mechanised vessels suffered a serious set back in terms of both total quantity of fish catch and the income earned.

The landing by the single-day trawl declined by 26.4% (1,756 t) in 1998-'99 compared to last year. However, when compared to the average annual landing of the preceding five years, the production was higher by 14.3% (611 t).

For the multiday trawl fisheries, 1997-'98 was the most productive year with 30,025 t compared to the annual average of 13,938 t for 1993/'94-1997/'98. During 1998-'99 the landing of 14,978 t was less by 50.1% (15,047 t) compared to 1997-'98 but 7.5% (1,040 t) higher than that of the five-year average. The cpue in 1998-'99 was also higher than the previous four

years, 1993/'94-1996/'97 but less than that of 1997-'98 by 32.4% (1,087 kg). Compared to 1997-'98 the catch and CPUE declined in all months except November. Specieswise landing also indicated a fall in all resources except anchovies and threadfin breams.

Economic loss to the fishery sector

During 1998-'99, the marine fishery sector at MFH has incurred a loss of Rs. 2,537 lakhs compared to the previous year (Table 11). Though the purse seine fish landing (379 t) increased marginally by 3% compared to 1997-'98, the boat owners (85 Nos.) suffered an economic loss of Rs. 68.9 lakhs (Rs.0.8 lakhs/boat) due to reduced availability of high value species like mackerel and oil sardine.

The gillnetters (motorised canoes) and indigenous gear operators (motorised and non-motorised canoes) landed better catches and gained a profit of Rs. 79.4 lakhs and 26.4 lakhs respectively (Table 11).

As the landing by single-day trawlers (440 Nos.) fell short of 26.4% (1,756 t) they incurred a loss of Rs. 57.5 lakhs (Rs.13,070/boat) (Table 11).

Among the different sectors, the multiday trawl fishery sector was the worst affected during the year. The production by 250 trawlers fell short of 15,047 t (50.1%) and incurred heavy lossess to the tune of Rs. 2,519.2 lakhs (99.3% of total income loss at MFH during 1998-'99) (Table 11). The loss to individual boat works out to a whopping Rs.10.08 lakhs. This enormous loss had led the fishermen to self-declare 1998-'99 as fish famine year.

Conclusion

Short-term, long-term and cyclic fluctuations in marine fish landings are common features and are governed by a complex of biotic and abiotic factors and the exact causes for these variations are largely unknown. Therefore, the decrease of 12.8 and 31.4% in the marine fish landings of the state and Udupi district with reference to Malpe Fisheries Harbour respectively during 1998-'99 can be treated as one such short-term fluctuations and hence, the year cannot be considered as fish famine affected, not withstanding devastating loss of Rs. 25.4 crores to the marine fishery sector of Udupi district.

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942 Book Review

Title	:	**Management of Fresh water Fisheries**
Author	:	**Jacques Arrignon**
Publisher	:	**Oxford and IBH publishing Co. Pvt. Ltd., New Delhi**
ISBN	:	**81 - 204 - 1324 - 5**
Year of Publication	:	**1999**
No. of pages	:	**582 + illustrations and B/W photographs**
Size	:	**160 x 245 mm**
Binding	:	**Hardbound**

Ever increasing human interventions in the natural ecosystems have caused habitat alterations/degradations and over-harvest of resources, often exceeded the carrying capacity/replenishing capacity, by an ever growing human population with the backing of a sophisticated, fine tuned technology in the harvest and post — harvest sector. These global phenomena have stressed more the easily assessable natural habitats and easily vulnerable species of developed and developing nations, warranting stringent controls, formulation and implementation of appropriate mitigative measures and management strategies suitable to each situation and region without alienating the beneficiary society, prevailing socio/economic/ethnic situations in the implementing regions concerned. With the awareness of the above ob-

jective, many nations have rose to the occasion to face the challenging problems in the natural resource exploitation and evolved appropriate management options, programmes, policies and whereever required legal mechinaries for a sustainable growth in this sector. The fresh water productive medium that traverses the terrestrial environment in the form of streams, rivers, ponds, lakes or back waters, which sustain life, has been severely trampled and stressed the world over by many natural causes on the one side and human interventions to the physical, hydrological and biological medium on the other side. In this back drop, a clear knowledge and understanding of the prevailing interactions and status of fresh water ecosystems, resources and the socio-economics has become an absolute necessity to assess the levels of consumption, both industrial and human, for the protection and management of the inland fresh water bodies. A structured multidisciplinary curriculum on fresh water fisheries is imperative to create necessary awareness and to produce a strong cadre of resourceful manpower who can rationally manage the inland fishery of the future.

The book under review **'Management of Fresh Water Fisheries'** by Jacques Arrignon is a very valuable compendium of knowledge on fresh water fisheries presented in three parts, such as ecological fundamentals, fish breeding and management of aquatic media. The appendices given in part four deals with formulae and programmes on the knowledge of aquatic medium, on the fish populations, about water and other harmful effects; the glossary, references and index spread over in sixty pages. This book is the English translation of the original French work *'Aminagement piscicole des eaux dauces'*, updated by the author for the English edition. In order to befit the title the author has carefully structured all relevant subjects in fresh water fisheries and expressed them in appropriate terms and in a more useful and effective manner than a scientific discussion. To widen the scope of this work, the author took special attention to stress the ecological context so as to help clarify and justify the reasons for the suggested practical solutions. The richness of ideas pervade throughout the chapters dealt in this book, whether it is ecology, fish breeding or management.

In part one of this book on the ecological fundamental a wide range of subjects like aquatic ecosystems, nature and dynamics of the components of a medium, fish and investigations in the medium are briefly explained in 190 pages, spread under four chapters with appropriate subtitles to highlight the thrust topics relevant to each chapter. Aquatic ecosystem connected zoning, typology, fluvial and limnology of hydrosystems / lakes are explained in chapter one with suitable diagrams and in clear understandable terms. The dynamics of freshwater medium is covered in chapter two under four sub headings such as terrestrial environment, water movement, water and biotic components. The subject matter narrations are substantiated with data, figures, diagrams, dendrograms, histograms etc. wherever necessary. Fish morphology, anatomy, classification and elements of physiology, biology and ethology are incorporated in chapter three of part one. The contents of this chapter especially the scientific terminologies, definitions and the sharp illustrations given at many places, are highly informative to students and researchers in freshwater fisheries. This chapter would have been richer and justified the sub title if age and growth was also incorporated at its end. In the chapter on investigations in the medium the author has incorporated the classification of the freshwater medium, sampling and tagging. The methodology for stomach content, scale and skeletal part examination, radio tracking, echo sounding are dealt with in this chapter with ample illustrations. Fish productivity estimation by different approaches and models, hydroecological studies etc. is also explained here in clear and understandable terms with the support of formulae and figures.

The part two of this book under review with nine chapters cover all possible and relevant themes of fish breeding which would serve as a text for post graduates and researchers in fresh-

water fisheries. The subject is carefully moduled under nine sub heads with suitable descriptions, data, diagrams and photographs spread over 170 pages. The chapter on improvement of natural spawning conditions consists of sections such as access to spawning areas, protection and improvement of spawning areas and artificial spawning beds. The latter section describes different methods like planting aquatic plants on the substratum fixed, floating — gravel beds; spawning channels to improve spawning beds, with diagrams and photographs. The need for *insitu* hatcheries, when media are not suitable for carrying out improvements, for the production of eggs/eyed embryos is vital for restocking the media. The second chapter is devoted to explain the different types of incubation boxes like vibert boxes and corchus box; incubator cradles such as spawning basket, artificial spawning bed and floating incubator for the *insitu* production of eggs/embryos, being liberally supported by sketches and photographs. The third chapter, growth in a natural medium, explains the hardiness of species, breeding media and improved extensive breeding. The author has taken care to incorporate all information on the reproduction/breeding of a range of fresh water fishes in the fourth chapter, titled induced breeding. The practice of making improvements that induce fishes such as cyprinids (gudgeon carp and asian carp), percomorphs (perch, pike perch, black bass), salmonids (arctic char, danube salmon and, common grayling coregonids) to reproduce is the main theme of this chapter, supported effectively with figures and photographs. In chapter five of part two, the various aspects of intensive fish culture is explained under six subheads such as, reproduction of trout, salmon, fertilization and incubation, hatching and rearing of fry, raising of summerlings, growth and mortality and introduction of salmon in natural medium. The various methods and technologies used to control the parameters of the breeding medium and the biocycle of the fish being raised are elaborated with the help of suitable diagrams in this chapter so as to produce the maximum number in a minimum amount of water, space and time at a minimum cost through intensive culture. Techniques of breeding the fresh water cat fish, sturgeon, eel, tropical tilapia, catfish, rice/pig/fish/duck/hen in integrated farming are briefly dealt in chapter six. The health problems in the medium, fauna and those associated with culture are elaborated in chapter seven under subheads like investigation of causes, therapy and prevention. The classification of the medium, situation and development are presented in the eighth chapter on suitability of media. The last chapter of part two of the book presents in detail all adverse effects to the medium and fish breeding. Here the author has narrated the adverse effect caused through historical changes, effects on the catchment area, effects on aquatic medium and pollution. Estimation of water quality using different evaluations on the medium as well as on the inhabitants etc. are explained with the support of data, illustrations and photographs.

The part three on management of aquatic media is presented vividly through three chapters such as physical management, intervention in the biological medium and economy of aquatic resources, each one being supported by diagrams and photographs. The maintenance of surroundings, clearing, removal of weeds and measures against muskrat are the subjects covered in the first module with maintenance of the aquatic media under chapter one. The ponds are classified in the second module according to origin, feed, arrangement and purpose. All aspects connected to creation of artificial medium are explained in the third module and the subjects are liberally illustrated with drawings. The other modules under this chapter include correction of water courses and management of water course for migratory fishes; the former explains correction works to prevent natural physical processes that might degrade streams, torrents, confluences and estuaries, while the latter narrates aspects of crossing obstacles by migrants, devices for their crossing and devices for sampling. The second chapter on intervention in the biological me-

dium gives the improvements required to ameliorate the culture ponds, means to create artificial equilibrium and fish production criteria such as selection of species, quantitative estimation, introduction of new load of fish and exploitation. The annual schedule of interventions in the culture ponds to appropriate pH by liming/calcite, pond fertility by phosphoric, potassic and nitrogenous mineral/organic fertilizers are emphasised in this chapter. The last chapter of part three of this book highlights the economy of aquatic resources through four subsections such as strategies of fish stocks, animal resources, suitability of medium and management of fishery resources. The author conceptualises the apt fish stocks management strategy as the one that aim for maximum production without compromising the productive future and distribution of species, and more economical and better respects to the law of nature. The concept of MSY and the pitfalls in strategy based on MSY are also explained here in detail along with the economic importance, and development needs in animal resources use. The suitability value of aquatic medium for recreational fishing and its development trends, preferably in the French context is also explained in this chapter. The last part of this chapter provides the administrative organization of fisheries management.

The last part of this book is appendices dealing with formulae and programmes on aquatic medium, fish populations, about water and harmful effects. This part is highly useful as it explains the minute details of methodology/formulae and calculations of various indices, and also provides proformae for samplings, models and computer softwares to derive equations etc. often required to guide and help students in the subject. The glossary gives suitable meaning/explanation/definition/interpretation of more than 300 words/technical terms. About 210 uptodate literature on all aspects covered in the text are cited under references; although many pertain to temperate waters and French works. This chapter ends with a seventeen page index list.

In order to evolve viable, economical and socio-politically acceptable and easily implementable strategies for the management of fresh water fisheries relevant to each geographical/ecological region with characteristic and unique socio-cultural conditions require a thorough knowledge, on the physical, chemical and biological condition of the media, the veracity of stress caused to the medium by both natural and anthropogenic effects, together with a clear understanding on the interventions and mitigative measures required to correct the medium and the ways and means to enhance the productivity through fish breeding and culture in tune with the laws of nature socially acceptable and adaptable.

The contents of the book are a collection of appropriate and authentic record of information which heavily deal with many fundamentals, general topics, methodology, breeding and culture practices, management of medium, which are relevant, applicable and replicable to many universal situations. As such this book fulfils most of the curriculum requirements of fresh water fisheries students of India. An intensive review made during the present exercise revealed that the book is not only useful to post graduate and research students but also to the faculty to supplement plan and align their fresh water fisheries teaching schedule. This book is a worthy addition to libraries and is recommended as a reference text for postgraduates/research students.

Dr. N.G. MENON

940 भारतीय उपतट से विदोहित मात्स्यिकी केलिए बेडों का अनुकूलतम आयाम का आकलन

के. एन. कुरुप्प और एम.देवराज

केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन

आमुख

भारत के समुद्री मछली उत्पादन की एक प्रमुख विशेषता है इसका वार्षिक उतार-चढाव, जो पिछले चार दशकों की उत्पादन सांख्यिकी से स्पष्ट हो जाता है । ऐसी स्थिति उत्पादन कार्यविधियों केलिए निवेश लगानेवालों को अनिश्चितता में डालती है । समुद्री मात्स्यिकी आज़ भी खुला प्रभाव्य है इसलिए अतिपूँजीकरण सहना पडता है । 40 मी से 80 मी गहराइ रेंच के तटवर्ती क्षेत्र जो 0.45 करोड वर्ग कि मी में विस्तृत है, में मत्स्यन दबाव अधिक होता है । लगभग 243,000 मत्स्यन पोत (182,096 परंपरागत, 26,171 मोटोरीकृत और 34,571 यंत्रीकृत यान) इस क्षेत्र में प्रचालन करते है, जब यहाँ की आकलित वार्षिक शक्यता 2.2 करोड टन होती है । मत्स्यन उपकरणों केलिए परिमित खर्च 33.4 अरब रु. है लेकिन इसके आगे प्रति एकक निवेश पर आय व्यवहार्य नहीं है । अविवेकपूर्ण स्पर्धा और अनियमित मत्स्यन विदोहित भंडार को नाश कर डालेगा और ऐसी स्थिति में वहनीय लाभ देने केलिए मत्स्यन पोतों का अनुकूलतम आयाम पर विचार करना प्रासंगिक होता है । इस पर निर्णय लेने केलिए पोतों का भौतिक पैरामीटेर, मत्स्यन प्रचालनों का आर्थिक सूचकों और मछलियों के जन्म-मरण के आँकडे संबन्धी सूचना अनिवार्य होती है । इन पैरामीटरों को एक संक्षिप्त गणित मोडल के रूप में तैयार करने केलिए अधिक समय लगता है, विशेषतः मत्स्यन प्रचालनों की बाहुल्यता की दृष्टि पर । तथापि इस पर एक वृहत्स्तर प्रयास किया गया जिसका नतीज़ा यहाँ दिया जाता है ।

एक वहुजातीय वहुसंभार प्रचालन साधारणतया एक प्रत्येक मत्स्यन एकक की प्रति एकक प्रयास पकड मछली प्रचुरता या उस एकक की दक्षता पर विश्वसनीय सूचना नहीं देती है । एक ही संपदा केलिए कई प्रकार के संभारों की प्रतियोगिता किसी भी मछली की प्रचुरता की विश्वासयोग्य सूचना देने में कभी सफल नहीं होगी । तथापि मात्स्यिकी विनिमयन के पैरामीटेर्स तय करनेवाले पकड, प्रयास और पकड प्रति एकक प्रयास ही होते है । इन पैरामीटरों में प्रयास को हम नियंत्रित कर सकते है और किसी भी अध्ययन से प्राप्त परिणाम पकड और प्रयास के रूप में परिवर्तित करने लायक होना चाहिए । अतः पकड और प्रयास के डाटा के आधार पर चलाये जानेवाला किसी भी अध्ययन जरूर फायदेमन्द हो जाऐगा ।

तर्कसंगत रूप से वर्तमान अध्ययन का आधार संभारवार पकड और प्रयास डाटा ही है । यह डाटा राज्यवार, संभारवार पकड, प्रयास और प्रति एकक प्रयास पकड के आधार पर है और इसको आगे वेलापवर्तियों और तलमज्जियों में विभाजित किया गया है । आनायों, कोष संपाशों, गिलजालों, बैगजालों, डोलजालों, अन्य यंत्रीकृत एककों (प्रमुखतः काँटा डोर), पोत संपाश, वलयसंपाश और गिल डोल जालों के प्रचालन करनेवाले मोटोरीकृत पोत और परंपरागत अयंत्रीकृत पोतों की पकड पर प्रथम दिशा में विचार किया गया ।

दूसरी दशा में वेलापवर्ती और तलमज्जी वर्गों के भारित प्रति एकक प्रयास पकड अलग से प्राप्त किया ।

भारित प्रति एकक प्रयास पकड (वेलापवर्ती) $= \frac{(13447 \times 83+117341 \times 2170+...306666 \times 35)}{134497+15188...+97779} = 403$

और भारित प्रति एकक प्रयास पकड (तलमज्जी) $= \frac{509384 \times 313+15188 \times 281+....97779 \times 11}{509384+15188......+ 97779} = 248$

1986 से 1996 तक के वर्ष केलिए वेलापवर्ती और तलमज्जी वर्गों केलिए भारित प्रति एकक प्रयास पकड इस प्रकार प्राप्त हुई है ।

मानकीकृत प्रयास (एस एफ)

इस प्रकार है: एस एफ=अवतरण / भारित प्रति एकक प्रयास

पकड x 1000 (प्रति एकक प्रयास पकड की इकाई कि ग्रा होने से)

इस प्रकार 1986 केलिए

एस एफ (वे) = 905693/ 403 x 1000 = 2245667

एस एफ (त) = 773680/ 248 x 1000 = 3124724

जहाँ 905693 और 773680 वेलापवर्ती और तलमज्जी वर्गों के कुल अवतरण होते है मानक प्रयास से प्राप्त कुल पकड लगाये प्रतिक्रिया कर्व वाइ=ए एफ-6 एफ^2 अधिकतम वहनीय पकड केलिए निम्नलिखित आकलन देता है ।

अ.व.प (वे) = 1215899

अ.व.प.(त) = 961485

विभिन्न राज्यों के विभिन्न मत्स्यन बेडों की प्रत्याशित अधिकतम वहनीय पकड वर्तमान औसत अधिकतम वहनीय पकड में डालने से प्राप्त हुआ । इस प्रकार पश्चिम बंगाल के आनाय बेडे केलिए 3858 की अधिकतम वहनीय पकड नीचे के अनुसार प्राप्त हुआ ।

3858 = 3807x 1215899/1199877, जहाँ संख्या 119987 वार्षिक वेलापवर्ती अवतरण (टन में) को सूचित करता है ।

इस प्रकार सभी राज्यों में वेलापवर्ती और तलमज्जियों केलिए प्रचालित सभी संभारों की अधिकतम वहनीय पकड का प्रत्याशित मूल्य प्राप्त किया ।

अधिकतम वहनीय पकड के अनुकूल प्रयास अधिकतम वहनीय पकड को पकड प्रति एकक प्रयास से भाग देने से प्राप्त हुआ । इस प्रकार वेलापवर्ती केलिए पश्चिम बंगाल में प्रचालित यंत्रीकृत आनाय जालों का प्रयास 3858/266 x1000 =14486 दिन देखा गया । इस प्रकार सभी राज्यों के अधिकतम वहनीय पकड आकलित किया गया ।

अधिकतम वहनीय पकड प्रयास के दो आकलन प्राप्त किया जिससे भारित अधिकतम वहनीय पकड इन आकलनों के एक भारित औसत प्राप्त करके किया गया । पश्चिम बंगाल के आनाय बोडों के अधिकतम वहनीय पकड के अंतिम आकलन इस प्रकार प्राप्त हुआ,

प्रयास (अ.व.प)=(14486 x 266+14098 x 428)/ (266 +428)

इस प्रकार सभी संभारों के राज्यवार प्रयास (अधिकतम वहनीय पकड) प्राप्त किया गया । बोडों का इष्टतम आयाम (पोतों या एककों की संख्या) प्रयास को एक वर्ष की प्रत्याशित प्रचालन संख्या (प्रचालन दिवस) से भाग देने से प्राप्त हुआ ।

परिसीमाएं

- आन्डमान और लकडीव्स द्वीपों केलिए किसी भी तरह का प्रक्कलन संभव नहीं है, क्यों कि संस्थान को इन क्षेत्रों के संभारवार उत्पादन से संबंधित विस्तृत जानकारी नहीं है ।
- अपेक्षित आर्थिक सूचकों की अनुपस्थिति में मात्स्यिकी द्वारा वहन करने लायक वास्तविक बेडा आयाम का सही प्राक्कलन साध्य नहीं है ।
- अभी तक का प्रक्कलन कुछ समय केलिए भी जारी रहेगा । पर अनुभव यह दिखाता है कि परिवर्तन हमेशा तेज़ होता है । उदाहरण केलिए लगभग छः साल पहले

तक महाराष्ट्र में कोष संपाश प्रचालन नहीं होता था । केरल में पोत संपाश जो परंपरागत सेक्टर में मुख्य था वलय संपाशों के आगमन से बाहर जा रहा है । वलय संपाश की प्रचालन दक्षता दिन-ब-दिन बढती जा रही है । कुछ स्थानों में आनायों का बहु दिवसीय प्रचालन सर्वसाधारण बन गया है ।

- ❖ परंपरागत स्केटर के उत्पादन में अधिक भाग तमिलनाडु और आन्ध्रप्रदेश से आता है । अतः इन दोनों राज्यों के अयंत्रीकृत एककों के प्राक्कलन पर और भी अन्वेषण आवश्यक है ।

उपर्युक्त के अनुसार इष्टतम आयाम मत्स्यन क्रियाकलापों में आनेवाले परिवर्तनों पर आश्रित है । परंपरागत मत्स्यन पोतों के तेज़ मोटोरीकरण की दृष्टि पर यह और भी स्पष्ट हो जाता है । कई समुद्रवर्ती राज्यों में परंपरागत पोतों का मोटोरीकरण पहले से भी कार्यक्षम जालों के निर्माण के लिए रास्ता खोला । इस प्रकार केरल में 4.8 ओ बी बी एस, 32.2 ओ बी जी एन 2.5 ओ बी आर एस और 73.5 एन एम एककों का प्रतिस्थापन हुआ । भारत के दक्षिणपशिचम तट में इस प्रकार के प्रतिस्थापन का समाज आर्थिक प्रभाव अत्यन्त कठिन और भयप्रद है ।

941 कर्नाटक में विशेषतः उडिप्पि जिले में 1998-99 की समुद्री मछली दुर्लभ्यता

सी. मुत्तय्या, उमा एस. भट, अल्ली. सी. गुप्ता और बी. श्रीधरा
सी एम एफ आर आइ का माँगलूर अनुसंधान केंद्र, माँगलूर- 595001, भारत

पिछले कई सालों से, जब कभी बाँगडे, तारली और कटिलफिश, स्क्विड्स, झींगे आदि उच्च मूल्य की संपदाओं में घटती और अनुवर्ती वित्तीय कठिनाईयाँ होती है, कर्नाटक के मछुआरे " समुद्री मछली दुर्लभ्यता" को एक समस्या के रूप में उठते है । सितंबर-अक्तूबर, 1998 में यानी मत्स्यन मौसम में अपनी प्रतीक्षा के अनुसार उच्च मूल्य की मछलियाँ प्राप्त नहीं होने पर यंत्रीकृत सेक्टर ने मछली दुर्लभ्यता की समस्या उठायी कि पिछले मौसम में ये संपदाएं सुलभ थी और तदनुसार वित्तीय लाभ भी हुआ था । ऐसी स्थिति में 1998 की इस "मछली दुर्लभ्यता" का रोदन कुछ विचारणीय बन जाता है ।

कर्नाटक का समुद्री मछली उत्पादन 1988-97 के दशवर्षीय अवधि में 1,76,506 टन के वार्षिक औसत के साथ 1992 और 1989 में क्रमशः 1,42,369 टन और 2,51,012 टन के बीच विविध था । वर्ष 1998 का उत्पादन 6.7% था और उपर्युक्त दस सालों की अवधि और प्रथम पाँच वर्षों (1988-92) की अवधि के औसत से 14.9% कम था, पर दूसरे पंच वर्षीय अवधि यानी 1993-97 की अवधि से 3.2% उच्च था । इस राज्य के समुद्री मछली उत्पादन में दिखाये पडे वार्षिक उतार-चढाव पिछले दशक के दरमियान के पूर्व के वर्ष की तुलना में 1990 के (-) 29% (वर्ष 1989 की तुलना में) से 1986 में (+) 59.5%) (वर्ष 1989 की तुलना में) तक की विविधता दिखायी । 1998 में उत्पादन में 12.3% की घटती 1997 की तुलना में मामूली है । यद्यपि विभिन्न वर्ग की मछलियों के अवतरण पर किये गये अध्ययन दिखाता है कि सेफालोपोड्स, फीतामीन, झींगे, बाँगडे आदि उच्च मुल्य की संपदाओं की घटती कर्नाटक के मछुआरों को 1997 की तुलना में 98 में 94.5 करोड रुपये का नष्ट पहुँचाया । माँगलूर - माल्प क्षेत्र में भी झींगे, बाँगडे और सेफालोपोड पकड की कमी

97 के आगे 19.4 करोड रु के नष्ट में परिणत हुआ । मछुआरों ने पिछले साल के समान इन उच्च संपदाओं की प्रतीक्षा पर थी, लेकिन इसके विपरीत उनको भारी नष्ट सहना पडा । इस कमी के कई कारण उन्होंने ढूँढ निकाला और अंत में वर्ष 1998 को “मछली दुर्लभ्यता वर्ष” घोषित किया ।

मछली दुर्लभ्यता - उडिप्पि जिले की स्थिति

उडिप्पि जिले में 31 मछली अवतरण / मत्स्यन गाँव होते हैं । सी एम एफ आर आइ द्वारा 1998 में चलाये गये संभार व यानों के सर्वेक्षण के अनुसार यहाँ 1,051 यंत्रीकृत पोत, 1,225 मोटोरीकृत नाव और 914 बिना मोटोर के नाव 100 कि मी लंबाई के तट रेखा के इस जिले में समुद्री मत्स्यन में लगे हुए है । इन में यंत्रीकृत पोत सितंबर - मई की अवधि में आनाय और कोष संपाशों का प्रचालन करते है जब कि मोटोरीकृत और मोटोर नहीं लगाये गये नाव सितंबर - मई के दौरान बडी जातियों केलिए गिलजोलों का प्रचालन करते है या मानसुन के दौरान छोटी मछलियों केलिए गिलजाल / वलय संपाश, कास्ट जाल, हैन्ड ट्रॉल आदि के उपयोग करते है । उडिप्पि जिला हाल में दक्षिण कन्नड जिले में द्विभाजित किए जाने के कारण सिर्फ इस जिला की मछली पकड़ सांख्यिकी उपलब्ध नहीं है । फिर भी राज्य के दो प्रमुख पोताश्रयों में एक यानी माल्प मात्स्यिकी पोताश्रय के समुद्री मछली उत्पादन का अध्ययन जो राज्य और भूतपूर्व दक्षिण कन्नड़ जिले के उत्पादन में क्रमशः 24.2% और 34.3% का योगदान देता है, से उडिप्पि जिले के 1998-99 के दरमियान हुई मछली दुर्लभ्यता का विश्वसनीय चित्र मिलेगा ।

वर्ष 1986-87 के दौरान कमीशन प्राप्त माल्प मात्स्यिकी पोताश्रय एक बारहमासी मत्स्यन पत्तन है और आज 775 यंत्रीकृत पोतों और 237 मोटोरीकृत नावों को अवतरण सुविधा देने में भी सक्षम है ।

माल्प मात्स्यिकी पोताश्रय के वार्षिक समुद्री मछली उत्पादन 1988-89 और 1997-98 के दशक में वार्षिक औसत 34,526 टन के साथ 19,601 टन (1995-96) से 55,906 टन (1989-90) में उतार चढाव दिखाया । इस अवधि के दौरान उत्पादन में घटती 5.8% (1995-96) से 40.9% (1990-91) में और बढती 7.2% (1988-89) से 98.9% (1996-97) में विविध थी । इस से व्यक्त होता है कि माल्प मात्स्यिकी पोताश्रय के वार्षिक उत्पादन में अखिल भारतीय या कर्नाटक समुद्री मछली अवतरणों के समान उतार-चढ़ाव अधिक था । प्रथम पाँच वर्षों की अवधि (1988/89-92/93) का औसत वार्षिक उत्पादन 39,192 टन था जो अनुवर्ती पाँच वर्षों की अवधि में घटकर 29,860 टन हो गया था । मछली दुर्लभ्यता से प्रभावित वर्ष में उत्पादन 0.4% (135 ट) और 16.1% (4,801ट) था जो दशवर्षीय अवधि के औसत उत्पादन और द्वितीय पंच वर्षीय अवधि, 1993/94-1997/98 की द्वितीय पंच वर्षीय अवधि से उच्च था । यद्यपि प्रथम पंच वर्षीय अवधि (1988/89-1992/93) की तुलना में 1998-99 में अवतरण 11.6% (4,531 टन) कम था । पिछले वर्ष (1997-98) की तुलना में भी, जो 50,558 टन अवतरण के साथ दूसरा श्रृंगकाल रिकार्ड किया था, 1998-99 के अवतरण ने 34.5% की घटती (15,897 टन) दिखायी । माल्प मात्स्यिकी पोताश्रय में 1989-90 और 1990-91 में भी समान प्रवणता देखी गयी थी । वर्ष 1989-90 में 55,906 टन का सबसे उच्चतम पकड रिकार्ड की तो अनुवर्ती वर्ष के उत्पादन में 40.9% (22,849) टन की घटती दिखायी पडी ।

माल्प मात्स्यिकी पोताश्रय में 1997-98 और 1998-

99 के दौरान सभी संभारों के मछली अवतरण का माहिक प्राक्कलन करने पर देखा गया कि यहाँ के 33 मछली वर्गों में 10 वर्गों ने 1998-99 के दौरान 2,408 टन की वृद्धि दिखायी । बाकी 23 संपदाओं ने 18,308 टन की घटती दिखाई है । इनमें कटिल फिश, सिक्वड्स, फीतामीन, झींगा आदि वाणिज्यिक मूल्य की संपदाओं की घटती मछुआरों को आर्थिक संकट में डाल दिया । 1998-99 में सभी संभारों द्वारा प्राप्त उत्पादन का मूल्य 5,049.4 लाख रु. था पर 1997-98 में 7,586.3 लाख रु. का उत्पादन प्राप्त हुआ था । अर्थात् 1998-99 में 2,536.9 लाख रु. का नष्ट हुआ था ।

माहवार समुद्री मछली अवतरण 1993/94-1998/99 के विश्लेषण के अनुसार 1998/99 की अवधि में उत्पादन में घटती अक्तूबर (665 टन) और दिसंबर (1,061 टन) के दो महीनों में हुई थी । जून और अगस्त की घटती विचारणीय नही है क्यों कि जून-अगस्त में यंत्रीकृत पोतों के प्रचालन में सरकार का रोध होता है । लेकिन 1997-98 की तुलना में नौ मत्स्यन महीनों में आठों में घटती हुई है ।

संभारवार परिदृश्य

कोष संपाश अवतरण

माल्प मात्स्यिकी पोताश्रय से 85 कोष संपशों का प्रचालन होता है । यह देखा गया कि वार्षिक पकड वार्षिक औसत 10,527 टन.के साथ 95-96 में 6,429 टन से 96-97 में 17,733 टन बन गया था जब औसत प्रयास 6071 एकक और प्रति एकक प्रयास पकड 1,734 कि ग्रा थी । 1998-99 में 6107 एककों द्वारा 2,099 कि ग्रा की प्रति प्रयास पकड के साथ 12,816 टन का अवतरण हुआ जो 10,527 टन के पंच वर्षीय औसत से 21.7% और पिछले वर्ष के 12,437 टन से 3% उच्च था । इससे स्पष्ट होता है कि "मछली दुर्लभ्यता" के वर्ष में कोष संपाश मात्स्यिकी अच्छी थी । लेकिन बाँगडे, तारली जैसी उच्च मूल्य संपदाओं की घटती से इस अवधि में कुल उत्पादन मूल्य में 4.2% (68.9 लाख रु) की घटती हुई थी । अतः 85 कोष संपशों में प्रति नाव का नष्ट 0.8 लाख रु. था ।

गिलजाल के ज़रिए मछली अवतरण

सुरमई, सुरा, शंकुश, ट्यूना, बिलफिश, शिंगटी, पाम्फ्रेट्स, बैराकुडा, करैंजिड्स आदि वडी जातियों केलिए यंत्रीकृत डोंगियाँ 65 से 135 मि मी तक के जालाक्षि आयाम के गिल जालों का प्रयोग करते है । मानसून की अवधि में प्रचालन नहीं होता है । 1993/94-1997/98 की पंचवर्षिय अवधि में वार्षिक अवतरण 373 टन के औसत अवतरण के साथ 1995-96 के 120 टन से 1994-95 के 577 टन में विविध था । 1998-99 में गिल जाल मात्स्यिकी ने 519 टन का उत्पादन किया । लेकिन प्रति एकक प्रयास पकड 1997/98 के 116 कि ग्रा से 1998-99 में 97 कि ग्रा में घट गयी । इसका कारण यह है कि 1997-98 में 3,886 एककों के आगे 1998-99 में 5,376 एकक लगाकर अधिक प्रयास किया था । 1993/94-1997/98 के दौरान एककों का वार्षिक औसत 3,283 टन था ।

गिल जाल प्रचालन से मछुआरों के 1997-98 के 172.3 लाख रु. के आगे 1998-99 में 251.7 लाख रु. का अधिक आर्थिक लाभ मिला ।

देशी संभारों के ज़रिए मछली अवतरण

माल्प में देशी संभारों का प्रचालन यंत्रीकृत पोतों के रोध के समय, यानी मानसून के दौरान किया जाता है । मोटोर लगाए गए और नहीं लगाए गए डोंगियाँ गिलजालों, वलय संपाशों, तट संपाशों, कास्ट जाल और हस्त ट्रॉलों के ज़रिए मत्स्यन करते हैं । पिछले वर्ष के आगे 1998-99 में मात्स्यिकी काफी अच्छी थी । 1998-99 में कुल अवतरण 1,463 टन

था जो 1993/94-1997/98 के पंच वर्षीय अवधि के अवतरण से 625 टन और पिछ्ले वर्ष से 459 टन अधिक था । इस मात्स्यिकी से 1998-99 में प्राप्त आय 3.1 लाख रु था जो 1997-98 में 2.8 करोड रु. था । अतः मछली दुर्लभ्यता के 1998-99 की अवधि में देशी संभारों की मात्स्यिकी अच्छी थी ।

एक दिवसीय अनाय अवतरण

सितंबर-मई की अवधि में लगभग 448 अनाय एक दिवसीय मत्स्यन करते हैं । ये प्रातःकाल से मध्याह्न तक 2-3 खींच करके अपराह्न / शाम तक पकड़ का अवतरण करते हैं । 1993/94-1997/98 तक की पंचवर्षीय अवधि में वार्षिक उत्पादन 2,046 टन (95-96) से 6,640 टन (1997-98) में विविध था और औसत प्रति एकक प्रयास पकड 228 कि ग्रा के साथ 4,273 टन थी । 1998-99 के दौरान वार्षिक पकड 4,884 टन (प्रति एकक प्रयास पकड 266 कि ग्रा) था जो उक्त पंचवर्षीय वार्षिक अवतरण से 14.3% (661 टन) उच्च था । यद्यपि 1997-98 के 6,640 टन के आगे 1,756 टन की घटती हुई है । 1998-99 में 19,026 एककों के ज़रिए प्रयास पांच वर्ष के लिए लगाए गए प्रयास से 1.4% अधिक, पर पूर्व वर्ष के प्रयास से 4.75% कम था । प्रति एकक प्रयास पकड़ (256 कि ग्रा) भी 1998-99 में बढ़ती की प्रवणता दिखाई ।

वर्ष 1998-99 के एक दिवसीय आनाय उत्पादन को 522.1 लाख रु. का मूल्य मिला जो पूर्व वर्ष के 579.6 लाख रु. से 57.5 लाख रु. कम था । इस वित्तीय घटती का कारण फीता मीन और क्रॉकेर्स जैसी उच्च निर्यात मूल्य की जातियों के उत्पादन में हुई कमी है।

बहुदिवसीय आनाय अवतरण

उडिप्पि जिले में बहुदिवसीय आनाय मत्स्यन केवल माल्पे में ही होता है । >12.8 मी ओ ए एल के लगभग 250 आनाय 100 मी गहराई के क्षेत्र में मत्स्यन करते है । 1993/94-1997/98 की पंच वर्षीय अवधि में इन अनायों द्वारा वार्षिक अवतरण 5,271 टन (1993-94) से 30,025 टन (1997-98) में विविध था और प्राक्कलित औसत 13,938 टन था । प्रति एकक प्रयास पकड 1,927 कि ग्रा के औसत के साथ 1,081 कि ग्रा (93-94) से 3,360 कि ग्रा (97-98) में विविध था । पंच वर्षीय अवधि के वार्षिक उत्पादन की तुलना में 1998-99 का उत्पादन 7.5% अधिक था । लेकिन 30,025 की उच्च पकड़ प्राप्त 1997-98 की तुलना में 1998-99 का अवतरण 50.1% कम था । वर्ष 1998-99 की प्रति एकक प्रयास पकड़ 2,273 कि ग्रा 1993/94-1996-97 से उच्च और 1997-98 से 32.4% कम थी ।

वर्ष 1997-98 में उच्च अवतरण और तदनुसार मछुआरों को उच्च आर्थिक लाभ भी मिला था । उत्पादन को 4,924.5 लाख रु. मूल्य मिला । यद्यपि 1998-99 के दौरान उत्पादन मूल्य 2,405.3 लाख रु. में कम हुआ जिसके अनुसार मछुआरों को पूर्व वर्ष के आय की तुलना में 50% नष्ट सहना पडा ।

1993/94-1997/98 के पंच वर्षीय अवधि की माहवार पकड और पकड दर की तुलना में वर्ष 1998-99 की पकड और पकड दर अप्रैल, मई, सितंबर, नवंबर और मार्च के पाँच महीनों के लिए समतुल्य या उच्च और अक्तूबर, दिसंबर, जनवरी और फरवरी महीनों में कम थी । 1997-98 की तुलना में माहवार कुल उत्पादन और पकड दर मत्स्यन के नौ महीनों में से आठें में कम और नवंबर में दुगुनी प्राप्त हुई थी ।

ऐंचोवी और सूत्रपख ब्रीमों को छोडकर बाकी सभी संपदाएं 1998-99 के दौरान बहुत कम थी जिसके फलस्वरूप बहुदिवसीय आनाय मत्स्यन में लगे मछुआरों को 25.2 करोड रु. का नष्ट हुआ । कटिलफिश, स्क्विड्स, फीतामीन जैसी निर्यातयोग्य मछलियों की कमी आर्थिकता को बुरी तरह प्रभावित किया।

सामान्य अभ्युक्तियाँ

कर्नाटक में समुद्री मछली अवतरण में पाये गये वार्षिक

उतार-चढाव देश भर की पकड प्रवणता के सदृश्य है । वर्ष 1998 का 1,64,710 टन का उत्पादन 1997 के उत्पादन से 12.3% कम और 1993-97 अवधि के औसत उत्पादन 1,59,567 टन से उच्च होता है । इसलिए राज्य में 1998 के उत्पादन में महसूस हुई मार्जिनल घटती राज्य की समुद्री मछली दुर्लभ्यता नहीं माना जा सकती ।

उडिपि जिले के 1998-99 की मात्स्यिकी के संबन्ध में कहे जाए तो, यहाँ के सबसे बडे उवतरण केंद्र माल्प मात्स्यिकी पोताश्रय में 1998-99 का उत्पादन पिछले कई वर्षों की तुलना में प्रसामान्य था । लेकिन इसके पूर्व 1997-98 में, जो माल्प मात्स्यिकी पोताश्रय 1986 में कार्यरत होने के बाद सबसे अधिक उत्पादन प्राप्त दो वर्ष है, के उत्पादन से 31.4 कम था । यही प्रवणता 1989-90 और 1990-91 में भी देखी गयी थी जब प्रथम अवधि में उत्पादन 55,905 टन के साथ उच्च और अनुवर्ती 1990-91 में 40% घटती रिकार्ड की थी ।

अध्ययन यह भी व्यक्त करता है कि यंत्रीकृत पोतों द्वारा कोष संपाशों के प्रचालन से पिछले वर्ष के अवतरण की तुलना में मात्रा अधिक थी, लेकिन 1998-99 में आय 1997-98 की तुलना में 4.2% कम था । मोटोरीकृत नावों द्वारा गिल जाल प्रचालन और मोटोरीकृत और मोटोर नहीं लगाए गए नावों द्वारा देशी संभारों के प्रचालन पिछले वर्षों की तुलना में प्रगति दिखायी । यंत्रीकृत यानों की आनाय मात्स्यिकी मछली की पकड मात्रा और आय में काफी पिछे थी ।

एकल दिवसीय आनाय मात्स्यिकी अवतरण पिछले वर्ष की तुलना में 26.4% कम था । यद्यपि पिछले पाँच वर्षों के औसत वार्षिक अवतरण की तुलना में 14.3% उच्च था ।

बहु दिवसीय आनायों केलिए 1997-98 30,025 टन के साथ सबसे अधिक उत्पादकीय वर्ष था । वर्ष 1998-99 के 14,978 टन का अवतरण 1997-98 की तुलना में 50.1% कम और 1993/94-1997/98 की पंच वर्षीय अवधि के औसत से 7.5% उच्च था । वर्ष 1997-98 में प्रति एकक प्रयास पकड भी पिछले चार सालों यानी 1993/94-1996/97 से उच्च थी , लेकिन 1997-98 के आगे 32.4% कम था । 1997-98 की तुलना में पकड व प्रति एकक प्रयास पकड नवंबर को छोडकर सभी महीनों में कम थी ।

आर्थिक नष्ट

माल्प मात्स्यिकी पोताश्रय के समुद्री मात्स्यिकी स्केटर को 1998-99 में 2,537 लाख रु. का नष्ट सहना पडा । कोष संपाश अवतरण में 3% की वृद्धि होने पर भी बाँगडे, तारली जैसी उच्च मूल्य की मछलियों की कम उपलब्धि से नाव के स्वामियों (85) को 68.9 लाख रु. का आर्थिक नष्ट हुआ ।

गिल जाल (मोटोरीकृत डोंगियों) और देशी संभार (मोटोरीकृत और अन्य) प्रचालकों को उच्च पकड और तदनुसार क्रमशः 79.4 लाख और 26.4 लाख रु.का उच्च लाभ भी प्राप्त हुआ ।

एकल दिवसीय आनायों ने 26.4% की घटती और 57.5 लाख रु. का नष्ट रिकार्ड की । विभिन्न सेक्टरों में सब से अधिक आर्थिक घटती बहु दिवसीय आनाय मात्स्यिकी स्केटर को हुआ । कुल 250 आनायों का उत्पादन 15,047 टन और नष्ट 2519.2 लाख रु. (माल्प मात्स्यिकी पोताश्रय के कुल नष्ट का 99.3%) था । प्रति व्यक्ति 10.08 लाख रु. का नष्ट उन्हें 1998-99 को "मछली दुर्लभ्यता वर्ष" घोषित करने केलिए प्रेरित किया ।

अभ्युक्तियाँ

लघु कालिक, दीर्घ कालिक और चक्रीय उतार-चढाव समुद्री मछली अवतरण में साधारण घटनाएं है जो जीवीय और अजैव घटकों द्वारा प्रभावित है, पर इस घटती - बढतियों का असली कारण अज्ञात है । इसलिए 1998-99 में माल्प मात्स्यिकी पोताश्रय के संबन्ध में इस राज्य के और उडिप्पि जिले के समुद्री मछली अवतरण में देखी गयी क्रमशः 12.8% और 31.4% की घटती को एक लघु कालिक उतार-चढाव माना जा सकता है और इस साल को "मछली दुर्लयता" के वर्ष के रूप में विचार नहीं किया जा सकता ।

शीर्षक : अलवणजल मात्स्यिकी का प्रबन्धन

लेखक : जाक्वस अरिग्नोन

प्रकाशक : ऑक्सफोर्ड एन्ड आइ बी एच पब्लिशिंग कंपनी प्राइवेट लिमिटेड, नई दिल्ली

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प्राकृतिक पारितंत्रों में मानव के आक्रामक प्रवेश से आवास में हेर-फेर/निम्नीकरण और संपदाओं का अतिसंग्रहण हो जाता है । आज बढती जाने वाली आबादी के साथ-साथ संग्रहण और संग्रहणोत्तर सेक्टर में हाल के सुविज्ञ प्रौद्योगिकी का आगमन पारितंत्र की वहन क्षमता/पुनःपूर्ति क्षमता को अक्सर पार करते है । इस भौगोलीय प्रतिभास अनायास निर्धारणीय प्राकृतिक आवासों और नाजुक जाति पर अधिकतम प्रभावित है जो सख्त नियंत्रण और उपर्युक्त प्रभाव कम करने केलिए उचित कदम उठने और प्रबंधकीय योजना बनाने केलिए चेतावनी देती है । यह कदम ज़रूर इससे लाभ पानेवाले व्यक्तियों को संक्रामित करनेवाले नहीं होना चाहिए और संवन्धित क्षेत्र के समाज/आर्थिक/जातीय हितों पर चोट लगानेवाला नहीं होना चाहिए । उपर्युक्त लक्ष्यों को ध्यान में रखकर कई राष्ट्रों ने प्राकृतिक संपदा चूषण की इस चुनौती के सामना करने केलिए उचित प्रवंधकीय विकल्प, कार्यक्रमों, नीतियों और आवश्यकतानुसार वैध नीतियों के साथ आगे आया । नदियाँ, तालाब, झील या पश्च जल क्षेत्र जैसे अलवण जल उत्पादकीय क्षेत्र जो स्थलीय पारिस्थितिकी को अनुप्रस्थ करते है कई प्राकृतिक कारणों और मानव हस्तक्षेपों के आघात से पीडित है । ऐसी स्थिति में अतःस्थलीय अलवणजल क्षेत्रों की सुरक्षा और प्रबन्धन केलिए अलवणजल पारिस्थितिकी स्थिति और इस पर अब होनेवाले हस्तक्षेपों की व्यक्त जानकारी अनिवार्य हो जाती है । अतः इस पर स्पष्ट जानकारी उद्भूत करने और भविष्य में अतःस्थलीय मात्स्यिकी का विवेकपूर्ण प्रबन्धन केलिए सक्षम और सशक्त मानवशक्ति के उत्पादन केलिए इस पर ठीक संरचित बहुविषयी पाठ्यक्रम अनिवार्य है ।

जाक्वस अरिग्नोन द्वारा लिखित समीक्षाधीन पुस्तिका "मैनेजमेन्ट ऑफ फ्रेश वाटर फिशरीज़" अलवण जल मात्स्यिकी पर एक अच्छा सारांश है जो पारिस्थितिकी, मत्स्य प्रजनन और जलीय माध्यमों के प्रबंधन जैसे तीन भागों में प्रस्तुत है । चौथे भाग में 60 पृष्ठें में दिये गये संलग्नकों में जलीय माध्यम की जानकारी से संबधित सूत्र, मछली जनसंख्या, जल और अन्य दोषकारी प्रभावों, शब्दावली, संदर्भ और निर्देशिका दिये गये है । यह पुस्तिका फ्रेंच भाषा में लिखित "एमिनेजनेम्नट पिसिकोल डेस इयाक्स डॉसेस" का अंग्रेज़ी अनुवाद है । लेखक ने पुस्तिका के शीर्षक के अनुसार अलवणजल मात्स्यिकी से संबंधित सभी बातों को सर्तकता से संरचित किया है और इन्हें उचित शैली और अधिक प्रभावी रूप में व्यक्त करके एक वैज्ञानिक पुस्तिका से ज्यादा एक चर्चा के रूप देने केलिए प्रयास किया है । इस कार्य के प्रयोजन बढाने केलिए लेखक ने

पारिस्थितिक संन्दर्भों को अधिकाधिक जोर देने का प्रयास किया है ताकि सुझाव के रूप में बताये गये प्रायोगिक समाधानों के कारण का स्पष्टीकरण किया जा सके या इसका औचित्य समझ दिया जा सके ।

पारिस्थितिक विज्ञान मूल पर प्रतिपादित इस पुस्तिका के प्रथम भाग में जलीय पारिस्थितिकी, एक पर्यावरण की प्रकृति एवं संघटकों की गतिकी, मछली और संबन्धित अनुसंधान जैसे विषयों के बारे में विवरण चार अध्यायों के अधीन 190 पृष्ठों में दिया गया है और प्रत्येक अध्याय से संबंधित विषय को विशिष्टता देने केलिए उचित उपशीर्षक भी दिये गये है । प्रथम अध्याय में मंडलन, प्ररूप-वर्गीकरण, झील आदि के नदीय और सरोवर-विज्ञान पर चित्रों और सरल सूत्रों के साथ व्याख्या दिया गया है । दूसरा अध्याय अलवणजल गतिकी पर है जो उपशीर्षक जैसे स्थलीय पर्यावरण, जल गति, जल और नितलस्थ संघटकों जैसे चार उपशीर्षकों के अंदर स्पष्ट किया गया है । जहाँ कहीं अवश्यक हो डाटा, चित्र, डेन्टोग्राम्स आदि भी दिया गया है । भाग-1 के तृतीय अध्याय में मछली के आकृति विज्ञान, शरीर क्रिया विज्ञान के वर्गीकरण और तत्व, जीव विज्ञान और आचारशात्र समाविष्ट किया गया है । इस अध्याय की अंतर्वस्तु विशेषतः वैज्ञानिक पारिभाषिक शब्दावलियाँ, परिभाषाएं और सुस्पष्ट निदर्शन अलवणजल मात्स्यिकी के विद्यार्थियों और अनुसंधानकर्ताओं के लिए बहुत ही ज्ञानप्रद है । यदि इस अध्याय के अंत में आयु और बढ़ती भी समाविष्ट किए जाए तो यह और भी महत्तर और उपशीर्षक को यथातथ्य या उचित सिद्ध कर दिये जाए थे । अन्वेषण पर प्रतिपादित अध्याय में लेखक ने अलवणजल माध्यम, सांपिलिंग और टैगिंग का वर्गीकरण शामिल किया है । इस अध्याय में जठर अंतर्वस्तु, शल्क और कंकाल निरीक्षण, रेडियो टैकिंग, एक्को साउंडिंग आदि पर भी व्यक्त निदर्शनों के साथ विवरण दिया है । विभिन्न सादृश्यों और नमूनों द्वारा मछली उत्पादकता आकलन और हाइड्रोइकोलोजिकल अध्ययन आदि का भी स्पष्ट विवरण सूत्रों और चित्रों के साथ दिया गया है ।

इस पुस्तिका का भाग -11 जो 9 अध्यायों के है, मछली प्रजनन से संबंधित सभी विषयों पर व्याख्यातित है । यह अलवणजल मात्स्यिकी के स्नातकोत्तर अध्येताओं और अनुसंधानकर्ताओं के लिए मूल-पाठ के रूप में उपयोग किया जा सकता है । प्रतिपाद्य विषय को नौ उपशीर्षकों के अंदर उचित विवरण, डाटा, आरेख, और चित्रों के साथ बहुत सर्तकता से अनुकूल किया गया है जो 170 पृष्ठों के है । प्राकृतिक अंडजनन स्थितियों की प्रगति के अध्याय में अंडजनन क्षेत्रों में अभिगमन, अंडजनन क्षेत्रों की सुरक्षा एवं प्रगति और कृत्रिम अंडजनन संस्तर जैसे कई विभाग होते है । अगला भाग अधःस्थन में जलीय पैधों का रोपण, स्थिर, प्लावी कंकडी संस्तर, आदि विवरण आरेख और चित्रों के साथ दिया गया है । अंडों/भ्रूणों के उत्पादन की प्रगति माध्यम के ज़रिए उचित न हो जाने पर हैच्रियाँ अनिवार्य हो जाते है । द्वितीय अध्याय वाइबेरट बॉक्स, कोर्कस बाक्स जैसे विभिन्न ऊष्मायन पेटियों, अंडजनन बास्केट, कृत्रिम अंडजनन संस्तर और प्लावी उष्मायित्र आदि पर है । तृतीय अध्याय "एक प्राकृतिक माध्यम में बढती" जातियों का तगडापन, प्रजनन माध्यमों, विस्तृत प्रजनन आदि पर विवरण देता है । लेखक ने चैथा अध्याय "प्रेरित प्रजनन" में अलवणजल मछलियों के पुनरुत्पादन/प्रजनन से संबंधित सभी सूचना देने में प्रयास किया है । इस अध्याय में साइप्रिनिड्स, पेरकोमोरफ्स, सालमोनिड्स जैसी मछलियों के प्रेरित पुनरुत्पादन का विवरण चित्रों के साथ दिया गया है जो इस अध्याय का प्रमुख विषय है । भाग-11 के पाँचवे अध्याय में इन्टेन्सीव मछली संवर्धन का विवरण ट्राउट का पुनरुत्पादन, साल्मोन, निषेचन और ऊष्मायन, पोना का हैचिंग और पालन आदि छह उपशीर्षकों के अंदर दिया गया है । इस अध्याय में

प्रजनन माध्यम के पैरामीटरों के नियंत्रण करने वाले तरीकाओं और प्रौद्योगियों, मछली का जीव चक्र का विस्तृत विवरण उचित अरेखों के साथ दिया है ताकि न्यूनतम जलमात्रा, स्थान और समय में न्यूनतम लागत पर तीव्र संवर्धन द्वारा अधिकतम उत्पादन किया जा सके । अध्याय छह में अलवणजल शिंगटी, सर्पमीन, ट्रोपिकल टिलेपिया, शिंगटी, चावल/सुअर/मछली/बतक/मुरगी आदि के समाकलित संवर्धन के बारे में संक्षिप्त विवरण दिया गया है । माध्यम के स्वास्थ्य को प्रभावित करनेवाले जीवजात और सहचारी जीवों के बारे में सातवाँ अध्याय में बताया गया है जिसमें कारण, चिकित्सा और रोक पर किये गये जाँच का विवरण दिया गया है । आठवाँ अध्याय माध्यम के वर्गीकरण पर है । इस पुस्तिका के भाग-II के अंतिम अध्याय में माध्यम और मछली प्रजनन में पडनेवाले सभी बुरे प्रभावों पर प्रकाश डाला गया है ।

भाग-III में भौतिक प्रबन्धन, दखल और जलीय संपदाओं की आर्थिकता जैसे तीन अध्यायों में जलीय माध्यमों के प्रबन्धन के बारे में प्रतिपादित किया है । माध्यम के अनुरक्षण के बारे में प्रतिपादित प्रथम अध्याय में परिसर का अनुरक्षण, सफाई, शैवालों का निकालना, गन्धाखु विरुद्ध कदम आदि विषय पर प्रकाश डाला गया है । इसके दुसरे भाग में तालाबों का वर्गीकरण किया गया है । तीसरे भाग में कृत्रिम माध्यम बनाने के बारे में है । मछलियों केलिए जल मार्ग का सुधार और प्रबन्धन भी इस अध्याय में प्रतिपादित अन्य विषय है । द्वितीय अध्याय " जैविक माध्यम में दखल" में संवर्धन तालाबों के सुधार केलिए आवश्यक कार्रवाई, कृत्रिम संतुलन बनाने केलिए और जाति चयन, मात्रात्मक प्राक्कलन, नई मछलियों की प्रस्तुति, विदोहन और संग्रहण जैसे मछली उत्पादन संबन्धी उपयों पर विचार किया गया है । इस पुस्तिका के भाग -III के अंतिम अध्याय जलीय संपदाओं की आर्थिकता पर है जो चार उपभागों में विस्तृत किया गया है ।

इस पुस्तिका के अंतिम भाग जलीय माध्यम के सूत्रों एवं कार्यक्रमों, मछली जीव संख्या, जल और दोषकारी प्रभावों के बारे में है । यह अत्यधिक उपयोगी है कि इसमें वर्गीकरण/सूत्र, विविध इन्डिसेसों का परिकलन, सांपिलिंग, मोडल्स आदि केलिए प्रोफोर्मे समवाक्य प्राप्त करने के लिए कंप्यूटर सोफ्टवेयर आदि से संबंधित मार्गदर्शन और सहायता देती है जो विद्यार्थियों केलिए उपयोगी है । इसके शब्दसंग्रह में 300 शब्दों/ तकनीकी शब्दों के उचित अर्थ /निदर्शन /विवरण आदि भी उपलब्ध है । पुस्तिका में प्रतिपादित सभी पहलुओं का लगभग 210 अद्यतन साहित्य संदर्भ के अधीन दिया गया है । यह अध्याय 17 पृष्ठ के अनुक्रमणिका सूची के साथ समाप्त होता है ।

अलवण जल मात्स्यिकी प्रबन्धन की सफलता केलिए माध्यम की भौतिक, रासायनिक और जैविक स्थिति, माध्यमों पर पडने वाले प्राकृतिक और मानव के विविध दखलों से होने वाले प्रभाव, इससे माध्यम को सुरक्षित करने का तरीका, जलमार्ग का सुधार, मछली प्रजनन और संवर्धन से उत्पादन बढाने का उपाय जो प्राकृतिक नियमों के अनुकूल और सामाजिक तौर पर स्वीकार्य हो आदि के बारे में ठीक ज्ञान होना अनिवार्य है ।

यद्यपि यह पुस्तिका फ्रेंच मूल का है, फिर भी इसका अंर्तवस्तु प्रामाणिक और कई मूल तत्वों और आम विषयों पर है कि इसका व्यापक उपयोग किया जा सकता है । भारत के अलवणजल मात्स्यिकी के विद्यार्थियों केलिए ही नहीं पढानेवालों केलिए भी उपयोगी है । यह पुस्तिका किसी भी पुस्तकालय केलिए एक मूल्यवान सम्पत्ति होगी और स्नातकोत्तर/अनुसंधान विद्यार्थियों केलिए पाठ पुस्तिका के रूप में स्वीकारने केलिए भी सक्षम है ।

डॉ.एन.जी.मेनोन

Announcement

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

has released a book in connection with its Golden Jubilee (1947 - 1997) entitled

Marine Fisheries Research and Management

Edited by V.N. Pillai and N.G. Menon

The book contains 61 articles under 6 sections; Marine biology, Marine fisheries, Pelagic resources, Demersal resources, Mariculture and Socio-economics & Extension. The voluminous data generated by the Institute in space and time over the last 5 decades on finfish/shellfish biology, resource status, marine environment, fishing impacts, mariculture technologies and socio-economics of culture and capture fisheries have been analysed and synthesised in the articles to enable to evolve suitable management policies relevant to each resource and each situation.

The subject matters broadly focus on the various aspects of marine biology, sensitive ecosystems, status of marine fish production, pelagic, demersal finfish/shell fish resources, role of remote sensing in fishery forecast, deep sea potentials, mariculture of finfishes, crustaceans, molluscs, sea weeds and other ancillary marine organisms along with the social and economic implications of fishery activities.

- The review articles are written by 118 experienced scientist/technicians of the Institute.
- This compendium has 914 pages with several figures and illustrations in Black and White.
- The book is hard-bound with calico, in 1/4th crown size.
- Price Rs. 500/-, US $ 150 + Rs. 150, US $ 12 respectively for packing and postage.
- Published by The Director, Central Marine Fisheries Research Institute, Cochin.

The book would serve as a reference guide to a range of clients in the fisheries sector, students, researchers and policy planners.

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